APR 13 1931

PUBLIC WORKS

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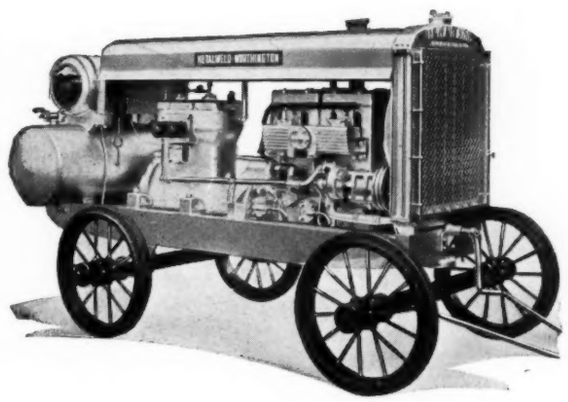
A LASTING TRIBUTE



to the engineering and business foresight of the Equipment Engineer who recommends their purchase . . . .

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PORTABLE AIR COMPRESSORS

The only portable air compressor equipped with "FEATHER VALVES," an exclusive WORTHINGTON patent. The only portable compressor incorporating *true* and *complete* full force feed lubrication. The only portable compressor with power unit embodying the long-life oil cooling and filtering design. The only portable compressor built on electrically welded rolled steel frame which is guaranteed unconditionally for the life of the machine. *The Quality Compressor in design and construction, METALWELD-WORTHINGTON portables are sold through a world-wide dealer organization. Write for complete catalog!*

METALWELD · Incorporated

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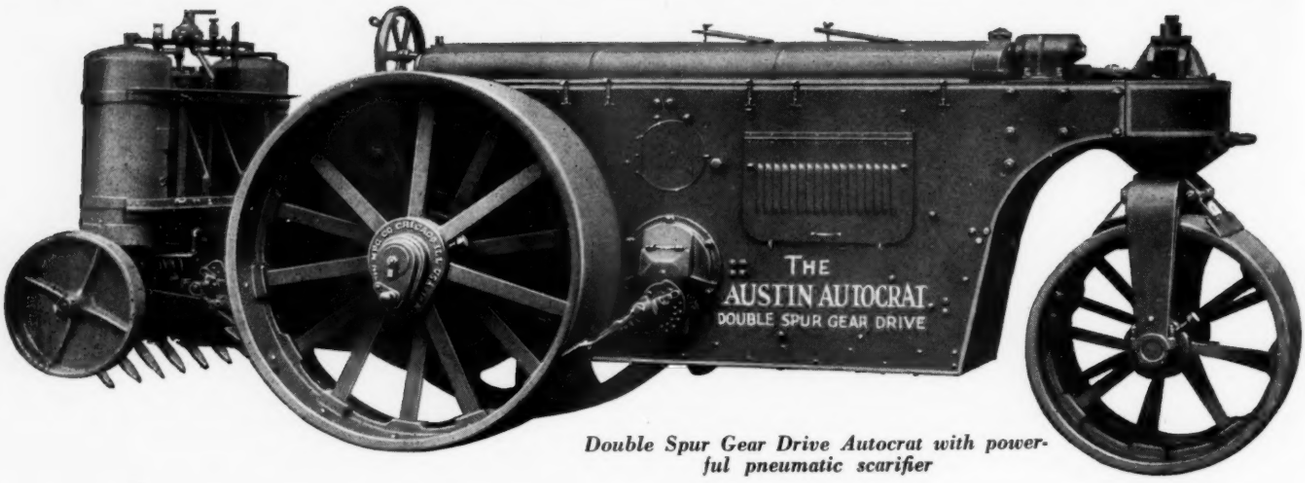
APRIL, 1931



Double Spur Gear Drive Autocrat with powerful pneumatic scarifier

There's a practical reason why every AUTOCRAT feature means better rolling results!

The new Austin Double Spur Gear Drive Autocrat Roller has established the Autocrat name more firmly than ever at the head of the list of fine performing rollers.

No expense has been spared to make it the *finest roller in the world!*

The startling improvements and refinements found in the new Autocrat are but natural results of the *highest standard of material and workmanship* ever put into a roller. A higher *factor of safety* has also been obtained. The normal life of the new Autocrat is *years* beyond that of ordinary rollers.

Outstanding features

The new Austin Autocrat is now equipped with a double spur gear drive of *exceptional efficiency.* A differential gear is regular equipment on all models. The heavy duty motor develops abundant power for rolling and the *toughest* scarifying jobs. An unusually short wheel-base increases maneuverability in close quarters. Amazingly easy to steer and handle! Low center of gravity *insures* smooth work and *prevents* side sway. Two speeds forward and reverse! Shifts from forward to reverse *without changing gears* or releasing master clutch!

Send for booklet

The Autocrat is made in 10- and 12-ton sizes. Write for descriptive literature for your files. The Austin-Western Road Machinery Co., 400 N. Michigan Ave. Chicago. Branches in principal cities.

Other Austin Rollers *include:*

The Austin Cadet, a completely factory-built roller, brings to the small, or pup roller field convenient operating features heretofore available only in the finest of the large rollers. Special transmission gives 3 travelling speeds forward and reverse. A 4-cylinder, heavy duty motor provides ample power for rolling, leveling and scarifying. Comes in 5, 6, and 7-ton sizes.

An Austin Pup Roller with a Case Model "CI" Power Plant.

An Austin Bull Pup Roller with Center Planing Blade and Rear Scarifier.

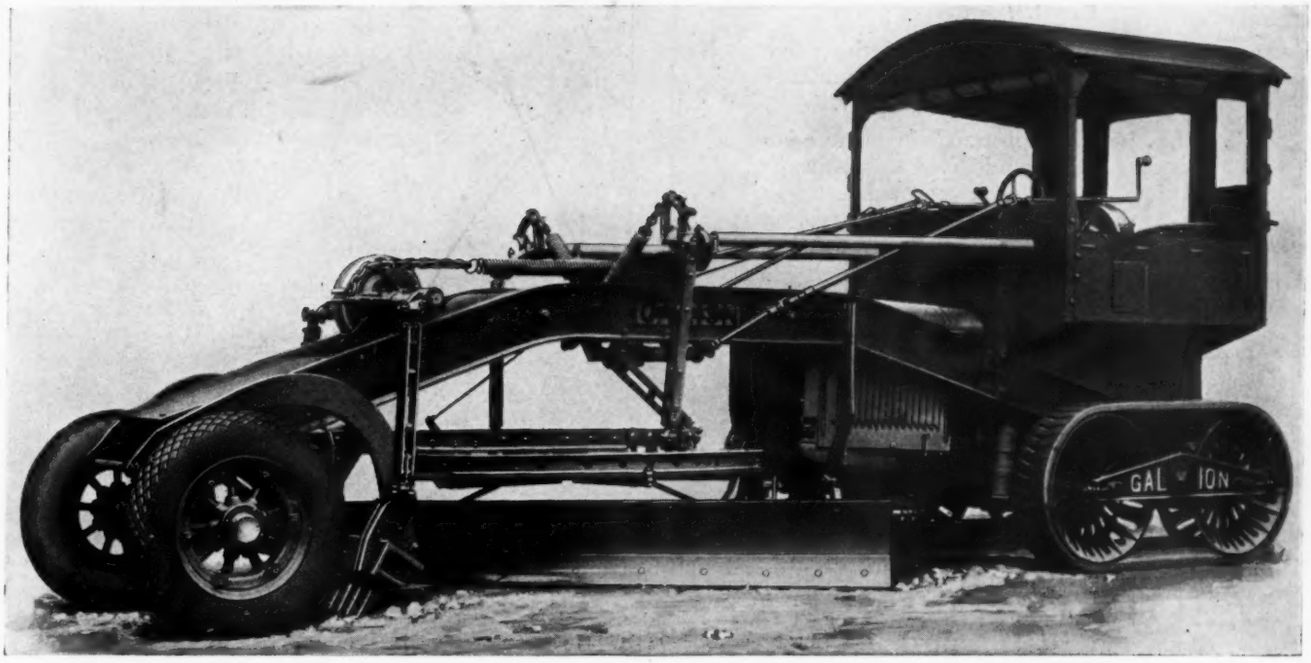
An Austin 4-Cylinder Tandem Roller.

Austin-Western
ROAD MACHINERY

VOL. 62 No. 4
Entered as second-class matter at the Post Office at New York, N. Y., Sept. 1, 1922, under the Act of March 3, 1879.
Published monthly by PUBLIC WORKS JOURNAL CORPORATION, 310 East 45th St., New York, N. Y.
Subscription price $3.00 a year. Single copies 35 cents.
APRIL, 1931

Announcing

The FINEST, STURDIEST and MOST POWERFUL MOTOR PATROL GRADER ever built



No Job Too Tough

The long standing Galion reputation "to build only the best" is again reflected in this 1931 model Motor Patrol Grader. A heavier frame, simpler and sturdier construction throughout, with the distinctive Galion E-Z Lift control, combine to make this a Motor Grader beyond comparison.

A choice of McCormick-Deering, Allis-Chalmers, Cletrac, Case or Twin City power, with pneumatic tires, solid tires, Galion Sure-trac Rubber Crawlers or Steel Crawlers, adapts this machine to any requirement.

Write for descriptive bulletin giving full details and features of this "Ace of Motor Graders".

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ARIZONA, Tucson—F. Ronstadt Co.
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San Francisco—Jenison Machinery Co.
CANADA, Montreal—Jeffrey Mfg. Co., Ltd.
Vancouver—Brown Fraser & Co., Ltd.
COLORADO, Denver—H. W. Moore Equipment Co.
CONNECTICUT, New Haven—Power Equip. & Serv. Co.
GEORGIA, Atlanta—R. S. Armstrong & Bros.
ILLINOIS, Rockford—Standard Road Equipment Co.
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UTAH, Salt Lake City—C. H. Jones Co.
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WISCONSIN, Milwaukee—Badger Trac. & Equipment Co.

SUCCESSFUL PERFORMANCE FOR A.G.C.A. JOBS

The Galion Iron Works & Mfg. Co.
GALION, OHIO

Table of Contents.....17; Industrial Literature.....91; Directory of Consulting Engineers.....87-88; Advertising Index.....98

MUNICIPAL
VERSUS
INDIVIDUAL

Water Softening

*Pamphlet on Request**

More than one hundred and thirty-five municipalities have found it economically sound to soften their water supply.

It has been demonstrated in many cases that consumers could afford to pay five or six times as much for softened water as for hard water and still save money.

*An interesting article on this subject was read at the Richmond Convention of the American Society of Municipal Engineers, by Mr. Charles P. Hoover, Chemist in Charge of the Cleveland Ohio Water Softening and Purification Works. A reprint will be forwarded on request.

Advisory Service Department
ZEOLITE CHEMICAL COMPANY
148 Cedar Street, New York

Greensand
ZEOLITE MINERAL

ICE and RUST Cannot Attack the Vital Parts
OF THE
MATHEWS
MODERNIZED
HYDRANT
Reg. U. S. Patent Office

No water or dirt can seep down around operating nut to freeze or clog.

The stop nut prevents buckling of stem if excessive pressure is applied in opening the hydrant or turning it the wrong way to close.

The location of the stuffing box prevents water entering the head or revolving nut to freeze or cause rust.

The completely revolving head enables nozzles to be set easily at any point in a complete circle without disturbing the barrel.

A broken Mathews Hydrant is easily replaced without digging; interchangeable with old installations.

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In business continuously since 1803
400 Chestnut St. :-: Philadelphia
CAST IRON PIPE AND FITTINGS
SAND SPUN (centrifugally cast) and PIT CAST
Reg. U. S. Pat. Off. GATE VALVES

With Our Authors

JACK J. HINMAN, JR., was born in Indianapolis, Indiana, October 14, 1888. In brief form, data regarding him are as follows:

Education: Purdue University, 1907-9: Butler College 1909-11, A.B. 1911. Graduate Work: Butler, M.Sc. 1915; University of Iowa, University of Rennes (A.E.F.)

Position Held: Associate Professor of Sanitation, University of Iowa, 1921 to date. (Employed by the University of Iowa, 1914 to date.)

Military Record: 1st Lieutenant and Captain, Sanitary Corps, (Water Supply) A. E. F. Water Supply Officer Base Section 3; Officer in Charge, Water Analysis Laboratory, American Embarkation Center, Le Mans.

Professional Association Record: President Iowa Engineering Society 1925; Secretary Missouri Valley Section American Water Works Association, 1915-1928; President American Water Works Assn., 1929-1930. President, Iowa Wastes Disposal Association 1929-30; 1930-31. Member of American Institute of Chemical Engineers, Associate Member American Society of Civil Engineers, Fellow of the American Public Health Association, Fellow of the American Association for the Advancement of Science, Member of the Association of Military Engineers.

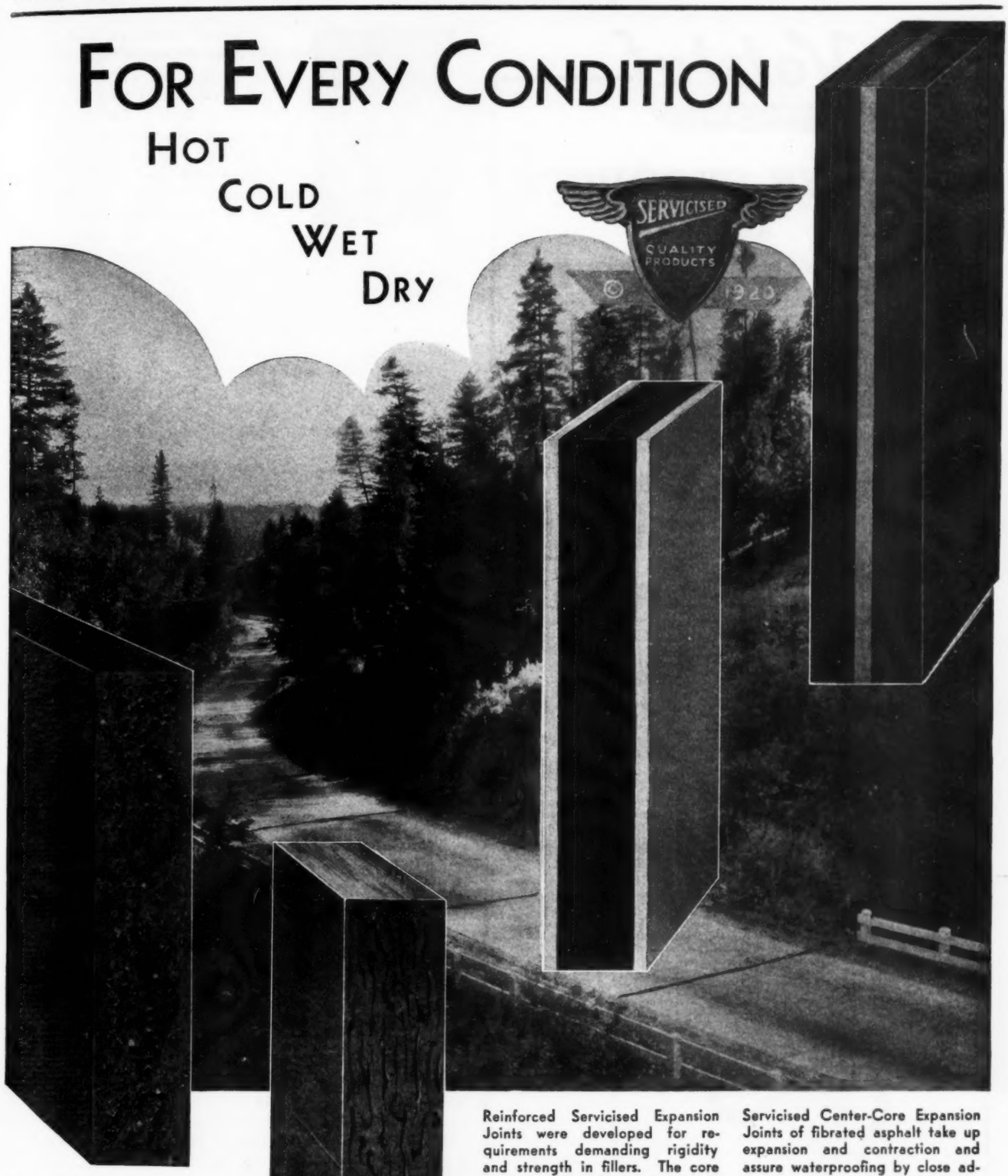
HENRY FOLZ is a graduate of Syracuse University, class of '17. Like a good many others about that time, he entered service with Uncle Sam, and in 1917 to 1920, served in the Navy as a Lieutenant. From 1920 to 1923 he was chief engineer of various steamships under the management of Moore & McCormack Co., and the Standard Oil Co. of New Jersey. For the following three years he was research engineer of the United States Rubber Co. Since 1926, he has been vice-president of Ralph B. Carter Co., New York, consulting hydraulic engineers, hydraulic contractors and manufacturers of hydraulic equipment.

Mr. Foltz' excellent article will be found on page 19. It contains some very valuable information for municipalities faced with the problem of getting more water for less money.

C. A. BINGHAM is Town Manager of Norwood, Mass. In his article on page 44 he gives some interesting figures on the costs of public works activities. We are sorry that we were not able to induce Mr. Bingham to send us his picture, or to give us any information concerning himself, but readers will find lots of real information in the rticle.

FOR EVERY CONDITION

HOT
COLD
WET
DRY



The Servicised Sponge Rubber Expansion Joint is the most perfect protection from severe water conditions and extreme heat.
A non-oozing super-elastic joint material—impervious to water.

Type "B" Servicised Expansion Joints are of special quality asphalt and selected fibres—very low in moisture absorption—maximum elasticity and plasticity—minimum of oozing—long life and resistant to traffic wear.

Reinforced Servicised Expansion Joints were developed for requirements demanding rigidity and strength in fillers. The core of fiber is heavily saturated with high quality asphalt and reinforced on the sides by sheets of saturated felt—a quality joint for certain conditions.

Servicised Center-Core Expansion Joints of fibrated asphalt take up expansion and contraction and assure waterproofing by close adhesion to the pavement proper. The fiber center core reinforces and furnishes elasticity while the fibrated asphalt sides guarantee adhesion to the pavement slab.

Write us of your conditions and get our recommendations.

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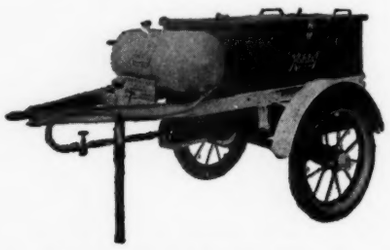
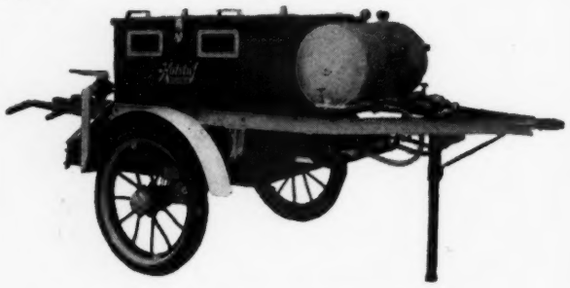
Hotstuf
TRADE MARK

MOHAWK PRODUCTS
ARE
REAL TIME SAVERS



TRAILER TYPE ASPHALT HEATER

Our patented construction eliminates coking by the natural flow of the hotstuff carrying the sediment to the storage chamber where it gradually carries off through the draw-off valve. Burning out of bottoms is practically unknown with HOTSTUF Heaters. No other heater has so many exclusive advantages as will be found in the HOTSTUF Heater. All HOTSTUF Heaters are furnished with the improved Mohawk Oil Burner having the patented removable coil feature.



COMBINATION TOOL AND ASPHALT HEATER

Model 'C'. The Combination Tool and Asphalt Heater produces hot tools and hot asphalt in 5 minutes from a cold start. Heats 16 tools or more at once. Holds 50 gallons of asphalt. The bottom level has no bolts or rivets to obstruct the tools while sliding in or out. The bottom is only 20 inches from the ground which makes an easy lift for the tools. Melts 5,000 pounds in 8 hours. Fifty gallon capacity.

HI-SPEED TOOL TRAILER

An efficiency tool box. The all steel MOHAWK HI-SPEED TOOL TRAILER is especially designed for the road contractor, construction company and other various users. Each model has special compartments, partitions, trays, shelves and fastenings for tools and supplies. Double covers are waterproof and can be locked down. Made in 6, 7, and 8 foot lengths. Other sizes made to your specification.

Write for Catalogue and Prices

Mohawk Asphalt Heater Co.
SCHENECTADY, N. Y.

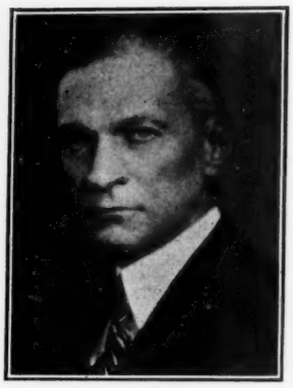
CHESTER MUELLER was graduated from Cooper Union with degree of B.S. in 1924, and from N. J. Law School with degree of L.L.B. in 1927. He received a post-graduate degree of C.E. from Cooper Union in 1928.

"Was employed in the Bureau of Docks, first as Rodman and later as Transitman, from 1921 to 1924. This was my first appointment in the service of the City of Newark and also my first engineering position.

"In 1924 was transferred to the Bureau of Streets, which is also part of the Department of Public Affairs, and promoted to the grade of Second Assistant Engineer. In 1926 was appointed Assistant Engineer in the same Bureau and in 1928 was appointed Principal Assistant Engineer, the position which I now hold.

"Am an Associate Member of the A.S.C.E., a member of the American Society of Military Engineers, and hold a commission as First Lieutenant in the Ordnance Reserve."

Mr. Mueller is the author of the article "Attaching Portable Bus Signs to Sidewalk," which appears on page 32 of this issue. We are glad to know Mr. Mueller and to have him as a contributor.



HENRY W. TAYLOR, Consulting Engineer, 11 Park Place, New York City, has written several articles for PUBLIC WORKS. In this issue appears an article regarding the Scotia, N. Y., water works. In his work two engineering factors are stressed. Without discounting technique and experience with detail, engineering judgment is of major importance in engineering projects. Engineering judgment includes a wide range of elements such as common sense, the engineering humanities, past experience carefully interpreted, and basic business considerations. If an engineer has done years of work and has not gained thereby good engineering judgment, this past experience has been largely wasted.

The protection of engineering design by initial maintenance of new projects is considered to be an absolute necessity. It is for the benefit of both the client and the engineer. Operation is the final test of a design and while this test is being carried on, the designer should be in constant touch with his plant, so that operation can be accommodated to design or very possibly, design can be thereafter, accommodated to operation. An untold amount of money has been wasted when new plants have been turned over to clients without initial engineering supervision of maintenance and these plants have indifferently accomplished their purpose and in many cases rapidly deteriorated.

J. J. JESSUP is city engineer of Los Angeles, Calif. In his paper discussing evils—and the remedies for them—of special assessments, he touches on a subject close to the nerve centers of many municipal engineers.

faster

ZONE OF WEAR—*where extravagant claims go "on the spot." At this point of contact heavy loads, rough going, high speeds and fast curves show up a tire's true quality. Here Goodrich Water Curing proves the uniform toughness it puts in a Silvertown.*

Balloon Tires **SPEED UP** Truck Deliveries, **WIDEN** today's Hauling Radius!

HIGHBALLING over the highways at 50-55 per hour is one way to put it.

Another is in terms of faster, more dependable transportation by truck, more miles and more deliveries per day, a *widened* hauling radius.

Balloon tires *speed up* trucking. They put the truck and the automobile on the same basis from the standpoint of speed and flexibility.

But look at it this way! In terms of your bookkeeping, how might balloon tires affect your costs? Suppose truck No. 12 covered 250 miles per day instead of 175? And what if Jones could go on to Westport and back every afternoon instead of making just four towns?

SPEED—quick deliveries—fast service—good drivers—Goodrich Truck Balloons are the foundation for all of that.

Don't stop at speed tho. Goodrich Balloons have seven other very practical advantages. Talk to the Goodrich Distributor about a change-over.

The B. F. Goodrich Rubber Co., Est. 1870, Akron, Ohio. Pacific Goodrich Rubber Co., Los Angeles, Calif. In Canada: Canadian Goodrich Co., Ltd., Kitchener, Ont. The International B. F. Goodrich Corp. (Export)

Why **BALLOON TIRES?**

30% more mileage—says a fleet operator. *10 m. p. h. faster*—from an inter-city express company. *Greater traction*—reports the contractor. *Repair costs cut*—the garage superintendent. *Easier on the load*—the records of a moving and storage house. *More towns per day*—a word from the delivery man. *Less fatigue at 5:30 P. M.*—the truck driver. *Heavier loads over hotter roads*—from the Imperial Valley, Calif.

Goodrich *Truck* **Balloons**

another B. F. Goodrich Product

32,000 Rubber Articles · Goodrich Silvertowns · Zippers · Rubber Footwear
Drug Sundries · Soles · Heels · Hose · Belting · Packing · Molded Goods

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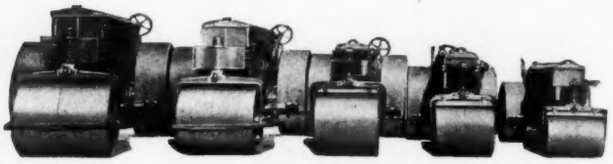
BUFFALO-SPRINGFIELD

THE RIGHT ROLLER FOR THE RIGHT JOB



The Buffalo-Springfield Roller line covers an exceptionally wide range of models and sizes. Whether for the heavy compaction demanded in the construction and maintenance of municipal streets, or for light compression work in public parks, on tennis courts, etc., there is a Buffalo-Springfield model to do it to the best advantage.

Built in weights from 2½ to 17 tons. . . . Three Wheel and Tandem. . . . Scarifier and other attachments optional

WRITE FOR ILLUSTRATED BOOKLET

THE BUFFALO-SPRINGFIELD ROLLER CO.
SPRINGFIELD, OHIO., U.S.A.

Castle Rock Obtains Water in Stream Bed

Castle Rock, Colo., with a population of about 500, has since 1916 been obtaining its water supply from galleries laid in the beds of East Plum Creek and Seller's Gulch, two ravines which meet at the town limits, which was brought to a 1,000,000 gallon reservoir through 8″ and 10″ wooden pipes. The supply from these was inadequate to meet the growing demands, and a new water line and galleries in East Plum Creek were constructed last year.

For galleries there was used 1,210 feet of Armco corrugated pipe with perforated ¼-inch holes, 1 inch apart on centers for 90 degrees of the circumference, double riveted and given two coats of hot asphalt. These pipes were laid from 16 to 23 feet deep, whereas the old galleries had been 8 to 16 feet deep. Similar pipe, but not perforated, 12 inches diameter and 1,220 feet long connected the new galleries with the old pipe line. The new pipe was laid in a straight line up the bed of the stream, extending the intake 2,400 feet farther. A 400-foot line of 15-inch, 16-gauge corrugated pipe, with ¼-inch perforations in 180 degrees of its circumference, was laid at right angles to the main line at the upper end. In order to gather every possible bit of seepage during the dry months, and prevent any water which had come in at the upper end of the line from leaking out, all perforations are turned up.

Concrete manholes were constructed, extending three feet below the pipe at angles and acting as sand traps. Hardesty "110" irrigation headgates were installed to shut off the water when traps are being cleaned. The perforated pipe is covered with 6 inches of ⅜ to ¾-inch screened sand, for a width of two feet. This strip is built up to the surface of the ground with clean, unscreened, gravel to facilitate seepage.

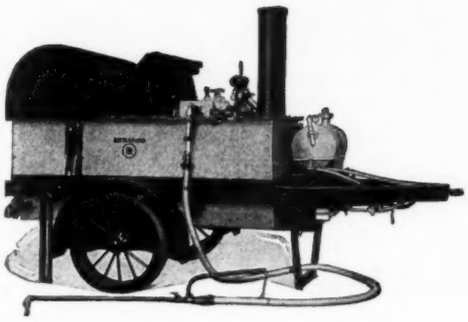
A Marion ¾-yard dragline was used in excavation and backfilling, working its way in places through a heavy growth of willows. Drainage of the trench while pipe was being laid was accomplished mostly by gravity, using a 4-inch centrifugal pump, operated by a Fordson tractor, for removing water from manhole excavations. A 4-inch hand diaphragm pump was used occasionally in removing mud from the excavation. A Little Wonder concrete mixer was used in pouring manholes. Eight men were employed on the job, including shovel operators.

L. C. Tuggle is water commissioner for the town; The Weiland Engineering Company, of Pueblo, are consulting engineers; John F. Rhoads is resident engineer; The Platte-Rogers Construction Company, of Pueblo, are the general contractors and C. A. Luce is the superintendent of construction. The pipe was furnished by The R. Hardesty Manufacturing Company, of Denver.

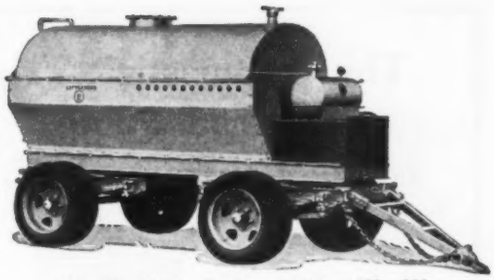
Municipal Watershed as a Game Refuge

The New Bedford, Mass., Water Board, in cooperation with the Massachusetts Fish & Game Association and the Massachusetts Forestry Association, is planning the establishment of a game refuge on the property held for the protection of the watershed.

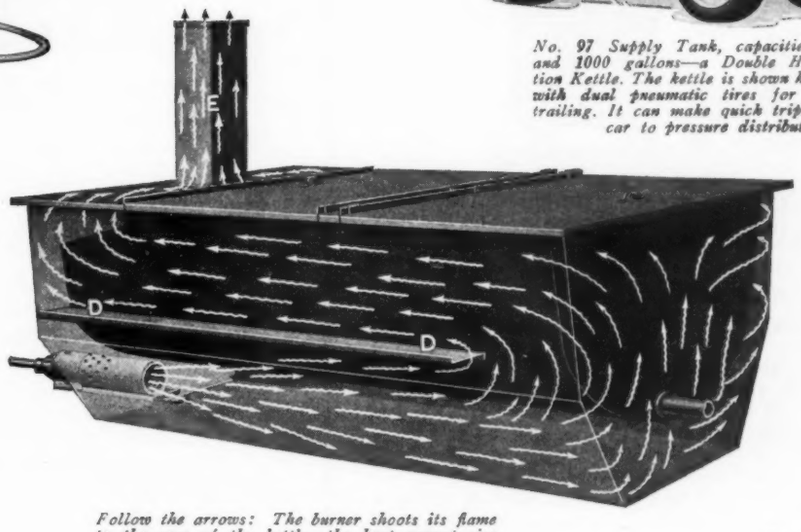
During the year 1930, 30,000 red pines and white spruces, purchased from the Forestry Division of the State Dept. of Conservation, were set out on the



The Trail-O-Heater—a 300 gallon, fast trailing asphalt kettle, can be furnished with solid or pneumatic rubber tires. When equipped with LB Motor Spray, it makes an ideal unit for penetration patching and small surfacing jobs.

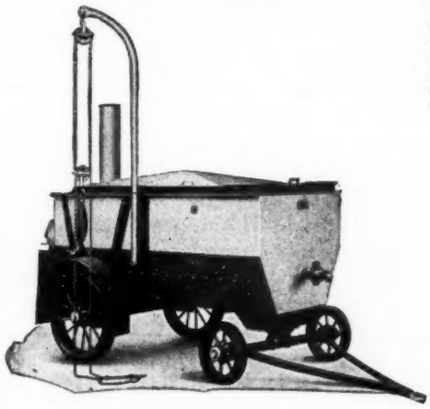


No. 97 Supply Tank, capacities—600, 800 and 1000 gallons—a Double Heat Circulation Kettle. The kettle is shown here equipped with dual pneumatic tires for high speed trailing. It can make quick trips from tank car to pressure distributor.

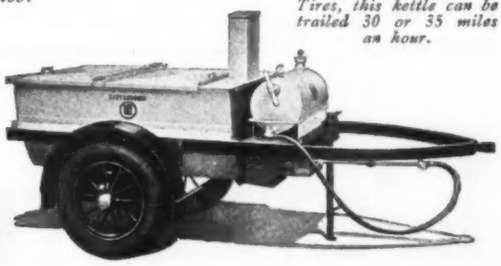


No. 83 Contractors' Special—an excellent kettle made in 300 and 550 gallon sizes. Insulated combustion box is constructed to develop Double Heat Circulation, resulting in unusually rapid melting of large batches of asphalt.

Follow the arrows: The burner shoots its flame to the rear of the kettle—the heat cannot rise until it passes baffle D—then it is drawn up and forward by draft to vent stack E. Heat has traveled full length of the kettle twice, giving a uniform heat throughout and melting asphalt in the quickest possible time. It saves fuel, too!



No. 84-HD Heavy Duty Maintenance Kettle made in 110, 165 and 210 gallon capacities. When equipped with Pneumatic Tires, this kettle can be trailed 30 or 35 miles an hour.



These KETTLES HEAT FASTER *because of* DOUBLE HEAT CIRCULATION

Asphalt Kettles
(Oil and Wood Burning)
Asphalt and Emulsion Sprayers
Tool Boxes
Tool Heaters and
Surface Heaters
Water Heaters and
Concrete Heaters
Steel Mortar Boxes
Salamanders
Joint Fillers
Squeegee Machines
Tools and Pots
Traffic Line Markers
Grout and Mastic Mixers

There is only one way to get fast melting of asphalt—without overheating, burning, or coking the material. That is by using a kettle that distributes its heat *uniformly* over the *entire area* of the melting tank.

Littleford Bros. have accomplished *uniform* circulation of heat through the "Double Heat Circulation" feature shown above. In this way tar or asphalt can be melted safely in the quickest possible time—no overheating . . . no burning . . . and coking practically eliminated.

Littleford Tar and Asphalt Kettles are the only kettles having Double Heat Circulation. Overcome grief on your maintenance work—Let us tell you how you can do it with Littleford Kettles. Write, today!

LITTLEFORD
Road Maintenance Equipment
SINCE 1900

THE SIGN OF A GOOD HEATER — LB — LITTLEFORD BROS. CINCINNATI, OHIO

LITTLEFORD BROS. 452 E. PEARL ST. CINCINNATI, O.

Reg. U. S. Pat. Off.

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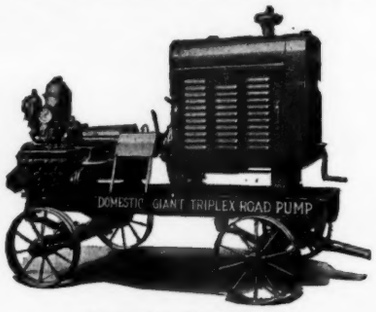
The "Domestic" Triplex Road Pump Is the Contractor's Friend



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watershed, and weeding and pruning of the older growths was performed.

Fire lines are maintained, being found especially necessary along the main highways, where a carelessly thrown cigarette or match might easily do heavy damage to the forest. A daily patrol of the watershed by the water board's patrolman and by the State police is maintained.

Road and Pavement Publications

Pavement Construction With Bit-u-muls. — The American Bitumuls Co., 200 Bush St., San Francisco, Calif., has issued 3 bulletins on pavement construction, maintenance, and retread work. These give practical information for the road builder and maintainer, and also should be of value to the non-technical official charged with the responsibility for this work.

Pavement Construction, 16 pages, 37 illustrations, discusses construction of pavements by the use of Bitumuls H. It covers light wearing surfaces for dry macadam or gravel; armor coat for stage construction; penetration surface on existing base; one-course, full penetration pavement of any thickness; 2-course penetration base and surface; salvaging worn and deteriorated surfacings; modernizing old-style high-crowned pavements; making non-skid surface on slippery pavements.

Maintenance, 16 pages, 29 illustrations, discusses the best and most economical methods of making repairs with Bitumuls H, and it is stated that such work can be accomplished easily because of the ease and economy of using dry uncoated aggregates and H.

Retread and Road-Mix, 20 pages, 44 illustrations, goes into detail of the use of HRM, a cold bituminous binder, for use in construction and reconstruction of road surfaces. The methods used successfully in a number of places are described.

Sewer Construction Unit Costs

Sewer Construction

WICHITA, KANSAS

Date of Contract—January 5, 1931

Cost of laying sewer pipe:	
6,207 ft. 60 in. reinforced conc. clay liner pipe, cost per ft.	$14.02
1,100 ft. 36 in. reinforced conc. pipe, cost per ft.	4.50
11,270 ft. 36 in. vit. clay pipe, cost per ft.	7.40
These prices include the cost of trenching and back filling in sandy loam soil.	
Cost of constructing 25 manholes, 15 ft. deep, per each	75.00
Cost of day labor per day, approximately	3.20

Total contract price: $206,000.
Contractors: 60 in. pipe, Swords-McDougal-Lancaster.
36 in. pipe, W. B. Carter.
Information furnished by L. K. White, assistant city engineer.
(From Kansas Municipalities)

LAWRENCE, KANSAS

Date of Contract, December 11, 1930

Cost of trenching and back filling:	
738 ft. 0'-6' clay and gumbo, cost per lin. ft.	$ .50
2,500 ft. 6'-8' clay and gumbo, cost per lin. ft.	.60
7,623 ft. 8'-10' clay and gumbo, cost per lin. ft.	.70
3,495 ft. 10'-12' clay and gumbo, cost per lin. ft.	1.00
485 ft. 12'-14' clay and gumbo, cost per lin. ft.	1.50
Cost of laying sewer pipe:	
1,407 ft. 10" Vit. clay pipe, cost per ft.	.70
13,439 ft. 8" Vit. clay pipe, cost per ft.	.55
120 ft. 10" C. I. Pipe, cost per ft.	3.00
These prices do not include the cost of trenching and back filling.	
Cost of constructing 12 flush tanks, standard depth	100.00
Cost of constructing 45 manholes, standard depth	60.00

Total Contract price: $21,283.80.
Contractor: Marsh Construction Company.
Information furnished by O. H. Stockwell, city clerk.
(Kansas Municipalities)

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An Engineering and Construction Journal

City County State

VOL. 62 APRIL, 1931 NO. 4

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ONE of the fine things about the engineering profession is the way the older men so often go far beyond the call of duty to teach the younger engineers and to help them advance in their profession. It is nice to watch these young men respond, and to see them justify this spirit, and this attitude on the part of their elders.

• • •

MOST of the contributors to this issue are of the younger group of men; and most of them happen to be ex-service men. We are particularly glad to welcome as members of our family Captain Jack Hinman, Lt. Folz and Capt. Mueller. In forthcoming issues will appear articles by the ever-young Major F. E. Daniels, charter member of the Order of the Boar, and by Capt. Don Hoffman of California.

• • •

RIGHT now our statistical department (along with a few pinch-statisticians from other departments) is wrestling with a flood or avalanche, or whatever you want to call it, of returns from our annual questionnaire to county engineers. We are surprised anew each year at the quality of engineering service that so many of the counties are getting. Ten years ago county engineering was almost a misnomer. Today there is not a finer group of men in the engineering field.

• • •

TWO years ago Andrew J. Provost submitted a bill for $3,000 to the city of New York representing 30 days consulting services. This bill has been the subject of protest, delay and wrangling by a city which claims it to be excessive, while blithely paying some of its special lawyers forty or fifty times as much without protest.

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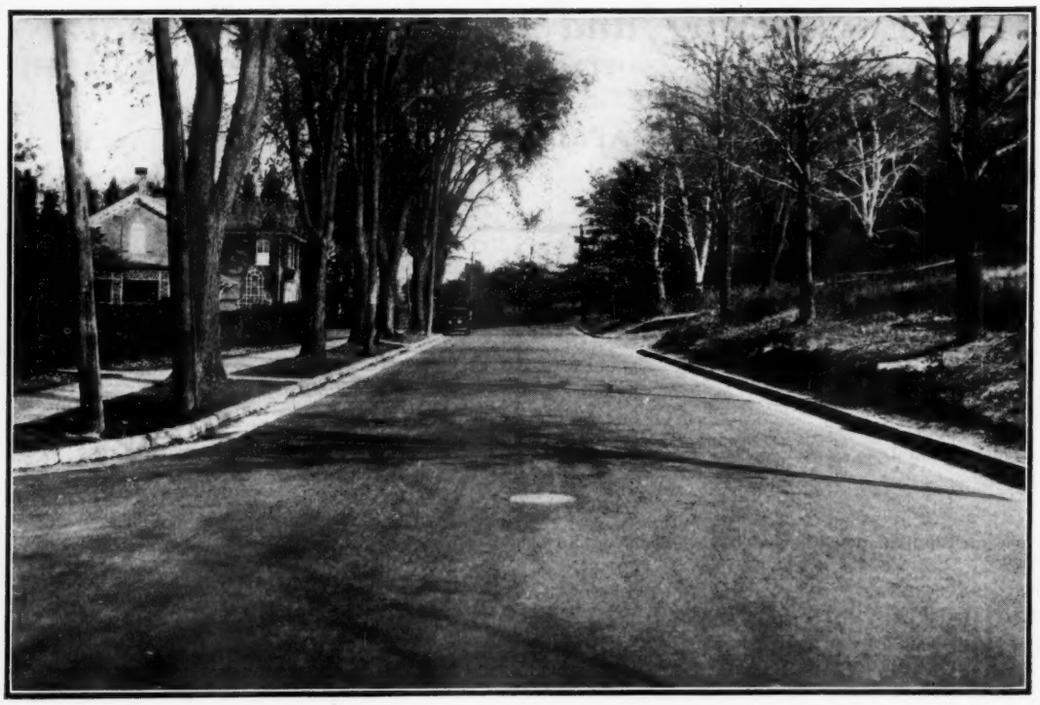

South Willard Street, Burlington, Vermont, paved with Standard Refined Paving Asphalt.

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PUBLIC WORKS

CITY COUNTY STATE

AN ENGINEERING AND CONSTRUCTION MONTHLY

Vol. 62 April, 1931 No. 4

Developing Underground Water Supply for a Small Village

By H. Folz

Of the Ralph B. Carter Co.

THE past two years of deficient rainfall have caused much suffering on the part of small towns and villages which have been dependent on small spring-fed reservoirs. Not only has the supply of water decreased but, due to the increase in population, the demand for water has increased. Even by early summer of 1929 the village of Millerton, New York, found itself facing such a water famine. Its water supply at that time consisted of a spring-fed reservoir and a small pumping plant. The pumping plant was located in the lowlands, using as a supply ground water feeding into a sump pit. The underground water here flowed through coarse flint gravel which was approximately sixteen feet thick, extending from bedrock to a layer of clay about five feet thick located about ten feet below the surface of the ground.

In order to make this source of water available, about sixteen years ago a concrete open-bottom sump pit was constructed to a depth of twelve feet. Thirteen 2-inch pipes were then driven through the clay bed into the water-bearing gravel, through which pipe the water rose into the sump. An 8x10 triplex pump was installed to deliver this water to the mains, any surplus water going to the reservoir.

How a small village, deriving its water supply from underground flow, increased the supply from the same source, by expert investigation of the geological conditions, and location and sinking of wells, is told in this article. Modern machinery was installed, the well pumps being operated by push-button control from the main pump house.

At top, deep-well turbine pump being lowered into well. Below, pumping No. 1 well during development. Center, test pump on No. 2 well. At right, pump house for deep-well turbine pump.

Until the early summer of 1929 this supply was adequate for all village needs. However, the first signs of drought caused the springs feeding the reservoir to dry up, throwing all of the load on the sump. By the end of the summer, conditions were such that the rate at which water reached the sump pit permitted only about six hours of pumping, whereas the village required about twelve hours at the rated capacity of the pump.

The villagers were asked to curtail their use of water and steps were taken immediately to provide an emergency source of water. A tractor-driven triplex pump was installed in an abandoned mine shaft and about a mile of four-inch cast iron pipe was laid, connecting up the pump to the distributing system of the village.

Due to the unsanitary character of this water, chlorination was used to make it safe. The village officials realized that steps must be taken to provide a more stable supply of water and employed the Ralph B. Carter Company of New York to locate and develop an underground source capable of supplying at least five hundred gallons per minute of pure water.

A careful survey of the surrounding country showed that the most desirable location for the extension of the plant would be at the site of the old pumping sta-

tion. Five 2-inch test wells were sunk, samples of the underground soil conditions being taken every five feet. From the data so obtained it was decided to sink two 10-inch wells to bedrock, and install fifteen feet of forty-slot all-brass screen.

Number one well was put down to a depth of 42 feet, and number two well to a depth of 53 feet. After developing these wells, a capacity of from five hundred to six hundred gallons per minute was obtained from each well with a drawdown of twelve feet. The water was of a high quality and proved to be satisfactory in every respect.

The 2-inch test wells were used to check the lowering of the water in the underground strata, the finished wells each being about twenty feet from a test well. Observations showed that forty-eight hours of pumping the wells lowered the water about four feet in the test wells.

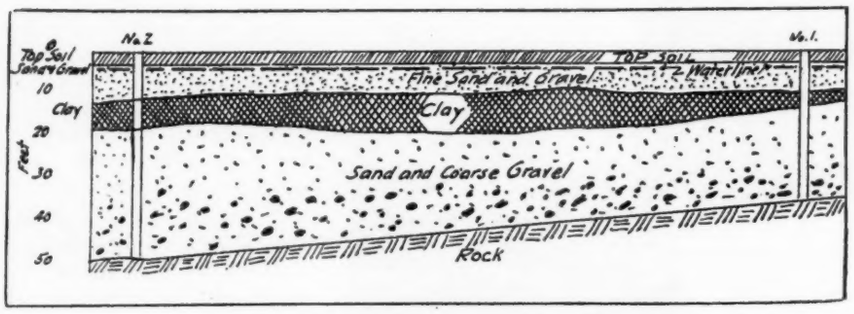
In each finished well was installed a two-stage Pacific deep-well turbine pump, which pumps were capable of delivering two hundred and fifty gallons per minute against a total head of forty feet. Each pump was driven by a five horsepower, asbestos-insulated, moisture-proof, U. S. motor, operating at seventeen hundred and sixty revolutions per minute. The pumps selected had a water efficiency of sixty-five per cent and were furnished with Edgewood self-lubricated enclosed shaft bearings. All shafting and inner columns were rustproofed by the Gardner-Flynn process, a plating of silver nickel alloy being deposited on all parts. All self-lubricated bearings were installed, eliminating the danger that oil would enter the wells, offsetting the possibility of contamination.

The pumps are operated by push button control from the main pump house. Concrete pump pits were erected at the well sites, six by seven feet inside dimensions. A six-inch underground discharge, with gate and check valves, was provided at each pump. Also, provision for a three-inch open discharge was made.

In the old pump house a two-stage, three-inch, type R, Fredericks centrifugal pump was installed. This pump was driven by a fifty horsepower Westinghouse squirrel cage motor, at seventeen hundred and fifty revolutions per minute. This pump has a capacity of five hundred gallons per minute against a head of two hundred and sixty two feet, with a water efficiency of seventy per cent.

Tests made upon completion showed that the deep-well turbine pumps delivered the water to the booster pump at five pounds pressure, and the booster pump delivered the water to the mains at a pressure of one hundred and ten pounds.

During the exceedingly dry spell encountered this summer the system provided an average of five hundred and fifty gallons per minute with a drawdown of six feet in each well.



Underground soil conditions revealed by sinking test wells

Changing Old Septic Tanks Into Digestion Tanks

COLUMBUS, KANS., in 1911 built two Cameron septic tanks, one on each side of the ridge upon which the city is situated, and contact beds for secondary treatment. Of recent years this sewage treatment plant has not been giving satisfaction. Different plans for a larger and better plant were considered, including concentrating all the sewage at a single plant by pumping or by building an outlet sewer down each valley one and a half miles to where the valleys join. The cost of either plan for a single plant was estimated at $90,000 to $120,000, and thought to be too high for a population of 3,200 people.

Last summer C. M. Cooper, consulting engineer, of Columbus proposed a plan for reconstructing the old plants which was adopted and a contract for the work was let on November 17 to Reed & Wheelock; and the reconstruction will probably be completed this spring. This plan consists of charging each of the septic tanks into a sedimentation and sludge digestion tank. Each of the old tanks had been constructed with a dividing wall, and was rebuilt so that one side, with the top removed and two deep hoppers installed, is to be equipped with a Hardinge rectangular clarifier. The sludge collected in these hoppers will be pumped into the tank on the other side of the partition wall, which will be used as a sludge digestion tank. This tank is roofed and sealed tight except for gas vents in the roof.

A pipe manifold is constructed over the digestion tank, with necessary branches and valves, which provides for circulation and complete turning over of the contents of the tank. The digested sludge is delivered to a new sludge drying bed. The supernatant liquid is returned to the inlet to the settling basin and there mixed with the incoming fresh sewage. One sludge pump handles both fresh sludge and ripe sludge and effects the circulating of the contents of the digestion tank.

The effluent from the settling basin is carried to a circular filter bed six feet deep, on to which it is discharged through a 90-foot "Cresset" distributor. The effluent from the filter is collected in a channel along the perimeter, which conducts it to a final settling basin provided with a stilling baffle and deep sumps. Sludge from this settling basin is pumped back to the digestion tank. The broken stone used as a filter medium in the old contact bed is used in the sprinkling filter, supplemented by the necessary amount of new stone.

The contract prices of the two plants are $25,330 and $25,227 respectively.

Maintaining City Pavements

How asphaltic, gravel, sand-clay and concrete are repaired and patched using asphalt of different consistencies, and in different combinations.

THE larger cities, such as San Francisco, Denver, Charleston, Los Angeles, New York, Washington, Philadelphia and Detroit report maintenance of large yardages of sheet asphalt, including reconstruction, at an annual average cost of 4.705 cents per square yard per year; maintenance of macadam by means of asphaltic materials using surface treatment methods (exclusive of major patching and reclamation) at an average of 6.55 cents; and maintenance of untreated gravel at costs ranging from 16 to 21 cents, depending upon the traffic.

Many of these larger cities are using the contract method of maintenance altogether, especially in repairing sheet asphalt streets and utility cuts, and in applying asphaltic surface treatment to macadam roads. The surface heater method of making repairs is done almost entirely by contract, although a few of the largest cities still use their own forces for surface heater work. But in general the tendency in almost all the large cities is toward contracting maintenance work.

Those large cities which have any natural soil roads to maintain are generally using a dust-laying oil known under Government Master Specifications as OC-2, in applications of $\frac{1}{3}$ to $\frac{1}{2}$ gallon per square yard. No attempt is made to develop a lasting surface, but the oil seems to be a much more economical and lasting method of laying dust than sprinkling water.

Macadam and Gravel Streets

In maintaining macadam, for work other than patching pot holes, these cities use asphaltic surface treatments quite generally, but differ widely among themselves in the kind and amount of asphaltic materials and the size of cover material used. There is, however, a distinct trend toward the use of a cut-back asphalt of a fairly heavy grade; also toward the use of a cover material, either gravel, stone chips or blast furnace slag, of three-eighths to three-quarters inch rather than the smaller sizes formerly employed.

Only very recently have the larger cities found it necessary to pay much attention to their gravel streets, which are generally confined to the outlying sections. Here asphaltic treatment of some kind is relied upon almost exclusively. Cut-back asphalt and asphaltic emulsions in place of hot treatment have become common.

Different treatment is required for the two distinct types of gravel—cementitious gravel, and that which is loose and sandy. The first may be thoroughly consolidated by traffic and only swept clean prior to the application of asphalt. The latter must be consolidated by a priming application prior to the distribution of the seal coat. In treating highly cementitious gravel, the best practice seems to be to

Cold patch repair work. Cold mixing of emulsified asphalt and stone chips.

apply the asphalt in frequent small amounts; by this plan small surface areas not entirely covered by the first application probably will be by a later one. While not the universal practice, it is probably advisable to precede the seal coat with a light prime coat of asphalt, even on the most compacted gravel roads.

In treating loose gravel roads, it is essential that the surface first be consolidated to a depth of one or two inches by use of an asphaltic oil of 60% to 70% asphalt or a cut-back primer, using approximately 0.4 gal. per square yard; then thoroughly mixing with disc harrow and grader, then smoothing and rolling. After the volatile oil of the prime coat has evaporated (from two days to several weeks) treatments are made with heavy oil, either hot asphalt or cut-back asphalt.

The use of the mixed-in-place or asphalt retread type of maintenance appears to be particularly popular for parks, suburban through roads and those with fairly heavy traffic where low cost is of prime importance. In many large park systems retread surfacing is being placed on old macadam, apparently with excellent results. Cut-back asphalt of a heavy grade and asphalt emulsions are used, but there has not yet been a general agreement on how much solvent should be used in order that the material be of the right consistency to permit ready mixing and yet not approach a sloppy stage.

Washington, D. C. has about 25 to 30 miles of gravel streets. In treating those made of highly cementitious gravel it has found that the cutting of a small trench along the margin of the finished surface approximately 3 inches deep and tapering within 18 inches of the swept grade is highly advantageous. This is in reality applying the maricopa section prin-

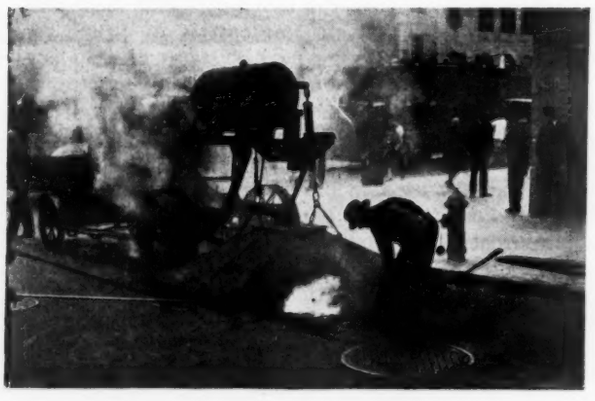
ciple which has been so successfully applied in the construction of concrete pavements. The edges or margins of the road are the first points to break, due to traffic running on and off, and by forming this trench at the foot of the crown, the asphalt that naturally runs from the crown to the side of the roads will gather in this trench instead of running out into the gutter; and the slag cover material, as it whips off, naturally moves to the side of the road and covers this trench. The traffic that runs over the edge of the road comes in contact with a 3-inch depth of surface treatment or semi-penetration construction, in place of the ¾-inch thickness of the general surface treatment, and the former is expected to withstand more abuse than the standard surface treatment, as well as preventing moisture from working under the mat.

For a priming coat after sweeping, Washington uses from 0.35 to 0.5 of a gallon per square yard of an oil containing about 55% asphalt and with a specific viscosity engler of 8 to 10. This prime is cut-back with an oil distillate or kerosene, in place of the common naphtha cut-backs, as Major Davison has found that oil primes which are cut-back with naphtha tend to make a mat which is somewhat brittle with a tendency to crack under traffic. Upon digging up samples of surface-treated highly cementitious gravel roads whose clay content analyzed 28%, it was found that a penetration (using this new oil prime) had been secured to a depth of from ½ to ¾ inch. If the road is closed to traffic for three or four hours after priming, no sop-up coat of sand or similar material is necessary.

For a seal coat Washington uses 0.36 to 0.44 gal. per square yard of asphaltic naphtha cut-back of approximately 78% asphalt, and covers it with 43 lbs. per square yard of blast furnace slag of which 100% passes a ¾-inch screen and 5% passes a ⅜-inch; this size is found much superior to the formerly used smaller sizes. They have had excellent results with slag weighing not less than 72 lbs. to the cubic foot, with the per cent of wear not to exceed 14, and with a French coefficient of not less than 4.4.

Bituminous Macadam

The larger cities use asphaltic seal coats or surface treatments for the major maintenance of their bituminous macadam, the minor maintenance being taken care of by hand-patching. Both hot and cold asphalts as well as asphalt emulsions are being used with marked success. The trend seems to be toward very light treatments made at intervals, with a larger size of covering material, in place of a heavy application of bituminous material.



Surface heating in New York City

In direct variance with the practice of state and county highway departments, cities are using a cold pre-mixed asphaltic type of bituminous concrete for their major and minor patch work, and this asphaltic bituminous concrete is both purchased under contract from a central manufacturer, and made up by local forces. This material, in addition to being used in the patching of macadam roads, has been used with marked success for the patching of broken areas in cement concrete roads and for the resectioning of old macadam roads. Some cities use as much as 16,000 tons annually, while others of equal size use comparatively little. Quite a few cities still use a liquid cold patch and make either direct or inverted penetration patches with excellent results.

Considering the traffic in large cities, it is the opinion and recommendation of the Committee on Maintenance of the Asphalt Paving Conference that the use of a cold-mixed asphaltic bituminous concrete is preferable to the liquid cold patch.

The use of a seal coat, using an asphaltic cut-back material, seems to be quite prevalent in the maintenance of old bituminous concrete pavements.

Surface Heating Repairs

The reports from such cities as San Francisco, Philadelphia, Los Angeles, Denver, New York City and Washington, D. C., show that all of those cities are large users of the surface heating method for repairing sheet asphalt, asphalt blocks, asphalt concrete and sand asphalt pavements. It is difficult to give a cost on this type of work that would even approach being general in application. The average range of costs seems to be from 60c to 90c per square yard for the completed repair. The results obtained using this heater method have been excellent, and as more of the newer types of asphaltic pavements age, it is probable that the surface heater method of repair will be used to a much larger extent. It is logical for the cities to contract this type of work, but San Francisco, which has just accomplished a program of 1,500,000 square yards, has done its own work and with highly satisfactory results.

Repair work on William Penn Highway

Cement Concrete

There is a wide variance in the experience of different cities in the use of asphaltic materials for the

(Continued on page 67)

The Schenectady Sewage Plant in 1930

View of trickling filter and emergency pumping station.

The annual report of Morris M. Cohn, sanitary engineer of the Bureau of Sewage Disposal of Schenectady, N. Y., contains (as always) several items regarding the operation of this plant that should prove interesting to plant operators.

Owing to the shortening of the bar rack, the trash impinged on the bars more directly during 1930 than it did previously, with the result that less wet trash was removed from the rack than formerly, and the consequent increase in clogging of the inlet gates of the Imhoff tanks which seemed to indicate that more rag and waste material passed through the rack. There were approximately 450 cloggings of the inlet gates during the year, which were removed by blowing out the conduits or by means of a special trash hook inserted into the pipe. The screenings removed from the rack averaged 1.3 cu. ft. per million gallons, the monthly averages ranging from 1.1 in January to 1.5 in March.

Imhoff Tanks

The Imhoff tanks were, as they have been for years, considerably overloaded and during the winter the sedimentation compartments were partly filled with deposited solids lying above the slots and "sludge islands" belched to the surface of the sewage. (The total depth of tanks from bottom to water line is but 14 feet.) The scum in the gas vents built down to a depth of over seven feet and sealed the slots along the south third of the tank lengths. Hosing was started as soon as possible, the tanks were cared for scrupulously to prevent the pre-digested sludge ebullitions from remaining on the tank surfaces, and intensive sludge drawing was started as soon as the sludge was in condition satisfactory for removing to the beds.

In spite of these difficulties the tanks performed their sedimentation function with very satisfactory efficiency and produced a sludge of fairly good quality. The removal of suspended solids averaged 64.8%, the monthly averages varying from a maximum of 76.5 in November (when the tanks were cleared of sludge to provide storage space for the winter) to a minimum of 44.7% in April, when the tanks were full and sludge belched up from above the slots and mixed with the tank liquor. The removal of suspended albumenoid ammonia averaged 62.8% for the year, the monthly averages ranging from 74.8% in December to 54.5 in May.

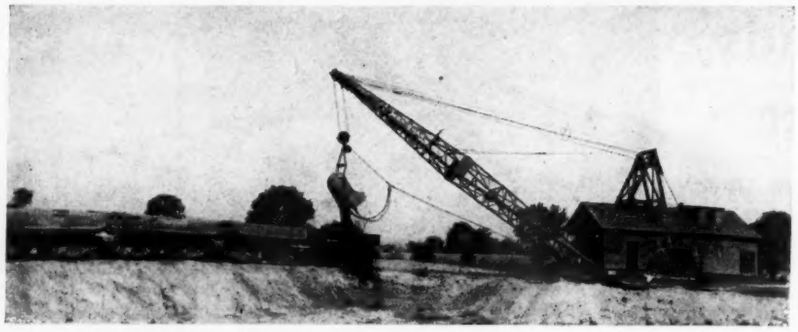
Grease curd and kitchen remains floating in the tanks, coupled with large amounts of belching sludge, necessitated constant skimming. All skimmings were placed into the gas vents because of the high sludge content, and then hosed down with the scum blanket. No deleterious effect can be noted as a result of this procedure. The sanitary disposal of skimmings is a difficult problem, and this method has seemed to be a fairly satisfactory solution of it. No unusual amount of undigested grease has ever been noted in the sludge drawn from the hoppers that receive the tank skimmings.

Auxiliary screens of hardware cloth were maintained at the effluent weirs at all times. A routine program of slot chaining was carried out during the year using a 45-pound drag chain, which cleared the slots of much deposited scum and sludge during the trying winter and spring storage period; and somewhat less solids than usual were found deposited in the sedimentation compartment in the spring.

The sludge drawn from the tanks averaged 94.90% moisture; 68.55% organic matter, 6.8pH and 1,008 specific gravity, and had a 24-hour drainability of

(Continued on page 68)

View of Imhoff tanks and buildings, Schenectady plant.

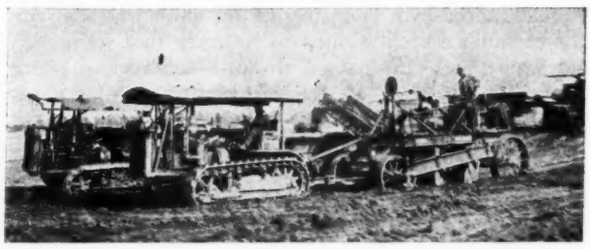


To the left is a Monighan dragline loading into cars on a job at Cairo, Ill. On the opposite page at the top is shown a dredge at work, and the business end of the pipe line. Retaining dike shown in rear.

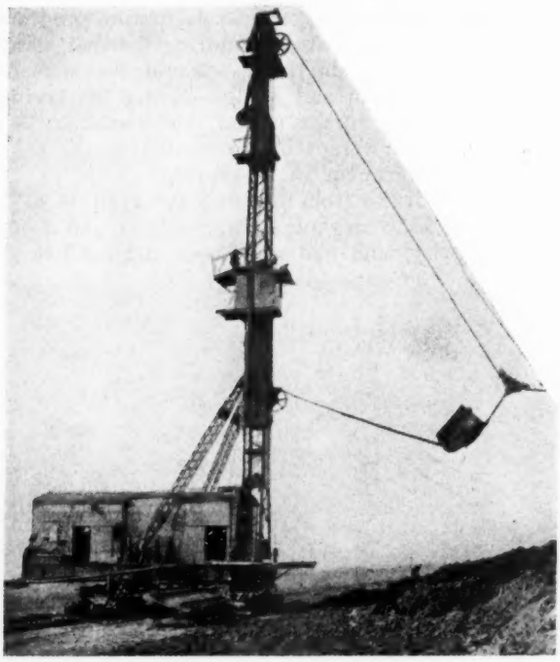
An Analysis of Equipment Used on Levee Construction Along the Mississippi

UP and down the Mississippi, now or formerly engaged on levee construction work, is scattered an assortment of machinery which in variety matches the contents of the well-known Mr. Noah's establishment. Why is this so? Why should there be no fairly standard method of handling dirt in large amounts? Levee work has been going on for forty years. Surely standard methods should have been worked out before now.

There are several reasons why the present conditions obtain. One is the varying borrow pit dimensions. In the Memphis section, a borrow pit slope of 1 on 50 is required, which means that dirt must be taken from just so much farther away than in the Vicksburg section, where a borrow pit slope of 1 on 25 is permissible, or in the New Orleans district, which allows a slope of 1 on 10. Naturally, methods will vary with the different borrow pit dimensions.



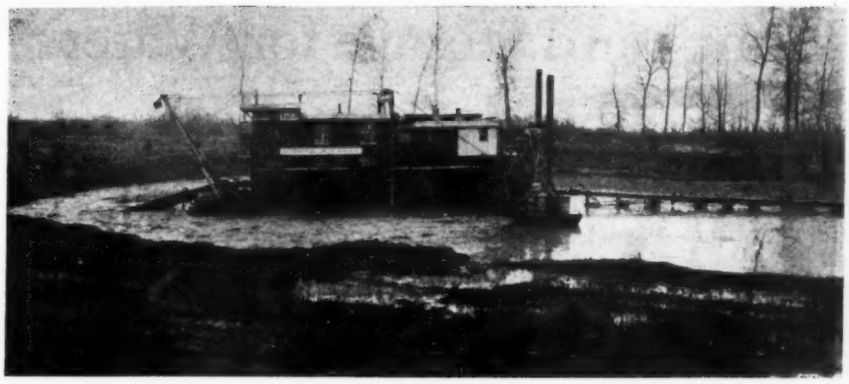
An elevating grader with crawler wagons.



The electric tower machine: It's a long way from the head →

The size of the levee, also, is an important factor. Although on the lower river, where the borrow pit slope is 1 on 10, draglines have always been a favored tool, tower machines had, prior to 1927, become accepted as the standard method of levee construction on the upper river. The increased section of the levee adopted as a result of the 1927 flood requires much more dirt per station; as a result, the borrow pit slope and distance from the levee remaining the same, longer hauls are necessary to secure the material required for the larger levees. Old style tower machines are now of doubtful utility, but improved models have been devised to overcome these handicaps and the tower machine again occupies an important place in the picture.

New methods, along with some of the old methods still being employed, provide a wide variety of construction processes. Now one will see the following methods of levee construction along the river: Tower machines; draglines; hydraulic dredges; combinations of these; mule-drawn trucks loaded with elevating graders; crawler wagons hauled by tractors; and loaded with shovels, draglines or elevating graders; industrial railways; and other equipment. It is known that no one of these is economically applicable to all conditions of construction, yet each, in its place, has advantages. Just what the final working out of the problem is going to produce in the way of equipment to meet this need, no one knows. It will be interest-



ing to the whole dirt-moving fraternity to keep in touch with developments along the Mississippi. Not only does it provide a most severe testing ground, so far as conditions of work are considered, for the machinery itself, but from the study, experience and observation of manufacturers there may emerge a new type of machinery which may influence markedly other construction fields.

Another view of an elevating grader.

The above types will be considered separately. Each will be discussed in the light of its advantages and disadvantages, and the type of work for which it is best fitted.

Mule Drawn Trucks—There are still quite a number of these along the river. Mostly, the trucks—and the mules, too—will not be replaced when they are worn out. The day of the mule is past, except for a few small jobs; and even on these it is likely that a truck or tractor unit of high mobility, like the Linn, can do the work more rapidly and cheaply.

Crawler Wagons—There is a good deal of difference of opinion about whether or not a contractor can make money with crawler wagons. Much depends, as a matter of fact, on the contractor; and this difference of opinion, as in the case of horse races, means something is doing. Crawler wagons have been developed to a very satisfactory state (tractors will be discussed in another paragraph), though it has been proved to be very difficult to get all the "bugs" out of one during its first year in the field.

On a haul of 400 to 800 feet, at 25 to 30 cents a yard, a good contractor will make money with crawler wagons and tractors, if he doesn't have any bad luck. A mediocre or inexperienced man is going to be pretty sure to lose.

Some contractors use two 5-yard wagons with one 10-ton tractor, saying that when the going is heavy, one wagon can be dropped, while when the going is good, about 10 yards a load can be carried. Two 5-yard wagons cost a little more than one 7-yard or 8-yard wagon—usually about 25% more. Other contractors, however, prefer one 7- or 8-yard wagon to a tractor; they save a little time in loading, as only one wagon need be spotted; they carry nearly as much dirt per trip, and they lose somewhat less time. When the going is heavy, they cut the load. One of the smartest contractors on the river prefers the larger wagons, and uses them invariably. He points out that the greatest repair cost on these wagons is crawler track; and that there is just twice as much track on two 5-tonners as on one larger wagon.

A new factor in the work is the large-wheeled wagon, illustrated in the March issue of PUBLIC WORKS. In the good weather conditions of last fall and winter these showed up very well.

A team of a 10-ton tractor and 7-yard wagon costs about $7,000 or a little more. Such a unit will put 40 to 50 yards an hour into place on the average job under favorable conditions, or 800 to 1,000 per 20-hour day. Five units will handle up to about 4,000 yards a day during good weather, but rain ties up such an outfit. Therefore, such a 5-team outfit might reasonably expect to handle around 350,000 yards during the 150-calendar day contract period. If the price is 30 cents a yard (which few contracts unfortunately are), the return is $105,000; the initial cost of equipment is around $40,000, plus loading equipment—a dragline or elevating grader. Tractor and wagon teams ought to be charged off in two years or a little more, for the depreciation is rapid under the conditions of work though they may continue useful and serviceable for a considerably longer period. In fact some of the units described in the March issue have been working steadily for three years, and are still in good shape.

Tractors — The tractor has become a very dependable tool. The average tractor will give almost unbelievable service, 20 hours or more a day, season after season, with relatively little trouble. They can be depended on for any kind of work.

(Cont. on P. 63)

To the tail tower.

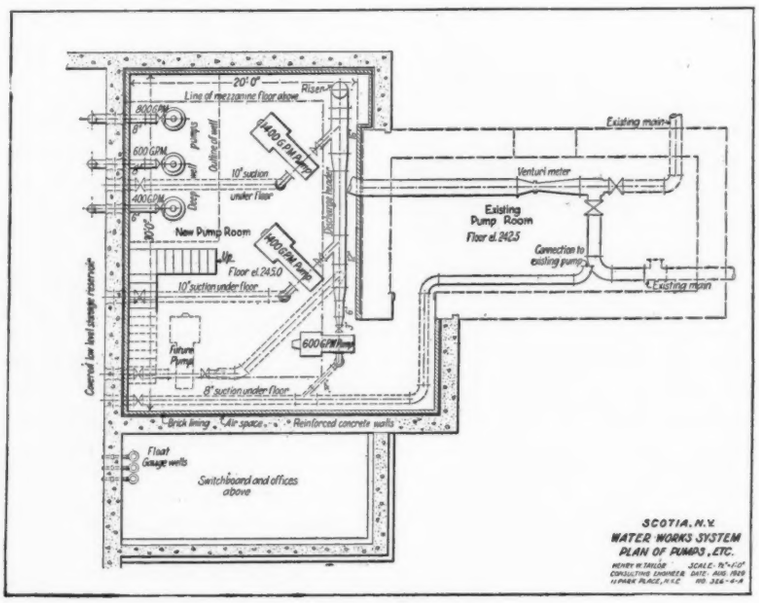
New Wells, Pumps and Storage for Water Works System of Scotia, New York

Ground water supply increased, automatic pumping apparatus installed with positive suction. New low level and high level storage permits of off-peak pumping

By Henry W. Taylor

IN September, 1929, an article was published in Public Works, which described the preliminary investigation of the water supply problems of Scotia, N. Y., and gave the basis upon which a decision was reached as to proposed improvements. To supplement this article, a description is given below of the construction as completed and the operation of the plant for a period of several months.

About twenty-five years ago, the Village of Scotia installed six 8" tubular wells, a small pumping station, a 100,000-gallon elevated storage tank, and distribution piping, which constituted the original water supply system of the village. With the growth of population, the water level in the wells frequently dropped to a stage which placed the existing pumping apparatus under an undesirable suction head, the strainers of these wells became clogged, and additional well capacity was highly desirable. The small capacity of the elevated storage tank necessitated pumping every other hour and three shifts of pump operators. The quality of the supply was unquestioned and the two main problems requiring consideration were that of increased quantity and suitable pumping apparatus and storage. The pumping apparatus must necessarily be re-designed to eliminate impracticable suction lifts, the rate of pumping must be increased, and the storage capacity must be enlarged so that pumping could be done on off-peak periods of the local power circuits.



Plan of pumping station.

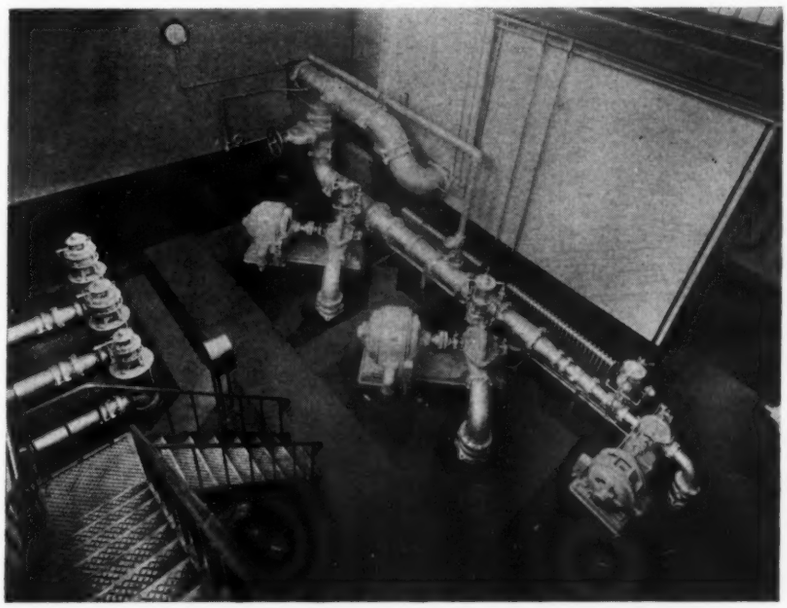
The solution of these problems was undertaken none too soon, for during the dry season of the past summer the water level in the water-bearing stratum dropped to an unprecedented elevation, and had it not been for the new pumping apparatus the village of Scotia would have been without water since June of last year. The new apparatus has met the test of an unusual hydraulic condition which probably will not again obtain for the next twenty-five or thirty years. The ground-water level has already indicated that it is undergoing correction by recent rains and thaws, and by spring this water level will be restored to a more normal condition, about ten feet above its present level.

Increased well capacity was obtained by the installation of an open steel-sheeted well, 10 feet by 15 feet in plan and 33 feet below the pump room floor, or about 50 feet below natural grade. The sand and fine gravel composing the water-bearing stratum proved to be unusually close-packed and the expected flow up from the bottom of the well was consequently not obtained except with undesirable head losses. This condition was overcome by pumping the well under big head losses, and the removal of a considerable quantity of the finer sand; also by burning holes in the steel sheeting, which permitted of a lateral flow to the well. Also well points were installed in a horizontal position, being driven through the holes in the sheeting and extending ten to fifteen feet in all directions from the well sheeting, which well points contributed a flow of water which completely filled the well point piping.

In order to continue utilizing the existing wells, connection was made to the old well header and a drop pipe installed which extended to the bottom of the new well. At the high point of the header, a one-inch connection was made, extending to a Shutte-Koerting water exhauster, which successfully removes the air from the high point of the header and main-

tains a vacuum of about twenty-two inches, thus insuring continuous action of the siphon which delivers the water from five of the old wells to the new open well.

Three deep-well pumps were installed above the new open well, which are submerged, for normal water levels, to a depth of about twenty-feet. These low-level pumps discharge the water from the new well into a low-level storage reservoir of 500,000 gallons capacity, which lies adjacent to the pump room and at an elevation to furnish positive suction for the new horizontal-shaft high-duty centrifugal pumps. These deep-well pumps are operated automatically by float control so that the low-level reservoir can be maintained full without attendants. The level of the pump room floor in the new pumping station is sixteen feet below natural grade, and the high-duty pumps, which take their suction from the low-level storage reservoir, are under a positive suction of ten feet when the low-level reservoir is full. The high-duty pumps consist of three units, two units of 2,000,000 gallons capacity and one unit of 1,000,000 gallons capacity. These pumping units are operated on off-peak periods, the main period extending from ten o'clock in the evening to seven o'clock the next morning. As the low-level reservoir contains a day's supply, the high-duty pumps can pump at any desired rate without necessitating rapid pumping of the wells. The wells are pumped on a twenty-four hour shift and at as low an average rate as the water consumption at any season of the year permits. The high-duty pumping can, if desired, be completed in a period of between two and three hours or can be extended over a period of six or seven hours, as may be desired.



View of pump room. Deep-well pumps at the left, high-duty pumps at the right.

The high-duty pumps can be controlled manually and are always started by the attendant. They can be stopped by the attendant or by a time clock; and are stopped by float control in case the low-level reservoir becomes exhausted. The discharge valves of the high-duty pumps are hydraulically operated gate valves. One side of the hydraulic cylinder of these valves is equipped with the usual manual control; the other side with a solenoid valve control. When the motor of a pump is in operation, these solenoids are energized and the valves are closed; but when the power is cut off from the motor by hand, by clock control, by float control, or by power interruption, these solenoids are de-energized, the valves open and the hydraulic valve slowly closes. To provide for leakage in piping which might, for some unexpected reason, close the hydraulic discharge valve while the pump was still in operation, a limit switch has been installed on the top of the hydraulic cylinder, which is actuated by the piston rod of the hydraulic valve and cuts the motor off the line just before the valve becomes completely closed.

It will be seen from the above description that the attendant of the station can start the high-duty pumping units at ten o'clock in the evening when the off-peak period occurs on the power circuits, stay in the station for a sufficient length of time to make sure that all apparatus is operating properly, and can then leave the station in the hands of the time clock control which has been set to give the number of hours pumping desired for any particular day. The low-level well pumping apparatus is left on automatic float control and takes care of itself. In case of power interruption during the pre-determined pumping period, the hydraulic discharge valves automatically close, and do so at a rate, against back-flow through the pumps, which creates a water wave and hammer not to exceed ten to fifteen pounds.

The described system of off-peak pumping at a high rate requires a suitable high-level storage capacity so that there always remains, during non-pumping periods, an adequate supply of water to serve the village. A new 16" force main extends from the pumping station to a concrete reservoir about 65 hundred feet distant, where necessary elevation was obtained for this structure. Interconnection to the existing mains from the old pump house were made at the pumping station. During high-duty pumping, the major quantity of the pumped water goes directly to the reservoir, only a small part of it being required to meet the immediate consumption; and during non-pumping periods, the village is served from the new reservoir, which has a capacity of 2.75 million gallons of water.

The general contract was executed by Feeney & Sheehan Building Company of Albany, New York. The pumping equipment is of Worthington Pump and Machinery Corporation manufacture; and motors, electrical apparatus and accessories are of General Electric Company manufacture. The two reservoirs are of reinforced concrete construction and the force main was constructed of Universal pipe. The total

(Continued on page 44)

Special Assessments—Some Evils and Remedies Therefor

AMONG the subjects which readers of PUBLIC WORKS have named as those which should, in their opinion, receive attention from this journal is the financing of public improvements. As an initial contribution on this subject, we present an abstract of a paper which was read at the City Engineers' and Street Superintendents' Section of the League of California Municipalities.

Concerning this paper, J. J. Jessup, city engineer of Los Angeles, writes us: "It has fallen to the lot of the city engineer of our several municipalities to apply and to make workable the various improvement acts which have been passed by our legislature. In this manner the engineers have been vouchsafed an excellent opportunity to become familiar with those acts, and to know from experience wherein they are good or bad. With the foregoing in mind, I requested three heads of divisions in this Bureau (of Engineering) to write papers dealing with the problems in their particular work, including therein analyses of the complaints against the improvement acts under which the work has been done, together with suggestions for remedial measures. These papers were edited and compiled into a single paper which, with extracts from that excellent volume 'Special Assessments in California' by James I. Tucker, compose the final draft that I am forwarding to you." The aim of this paper was, he says, "First, to provide serious and constructive thought on the part of all who seek to amend or revoke our existing improvement acts. Second, to impress upon city engineers the importance of their active participation in proposed legislation, to the end that new acts may benefit by their experience."

We are sorry that we can not publish this paper entire, but it treats the subject so exhaustively that to do so would require a large part of an issue of PUBLIC WORKS. Much of the matter, also, applies specifically to conditions and laws in California and especially in Los Angeles. In the following we have endeavored to give the salient facts and arguments as they are believed to apply to municipalities generally.

THE past ten years have witnessed an increase of 113% in the population of Los Angeles, and other California municipalities have shown even greater percentages of expansion. This has been accompanied by inevitable "growing pains," chief among which has been the cost of extensive programs of indispensable public improvements. Los Angeles City during the past ten years paid $111,896,800 for the development of streets, sewers, storm drains, and bridges; and this figure does not include the cost of land acquisition in connection with street opening and widening. A portion of this expense has been met out of bond issues and special taxes; but the great bulk of this expenditure has been financed by special assessments on property benefited by these various improvements. In addition to the foregoing, a vast expansion in schools, libraries, parks, playgrounds, and civic buildings has taken place.

So long as property values were constantly increasing and a rapid turnover in ownership was taking place, the constant repetition of assessments caused little irritation to the general public. The various improvements were admittedly needed, and, in the constant changes of ownership, assessments were paid off during transfer of title out of lot sales. Improvement cost, when defrayed in this manner, are quite painless.

During the past several years, however, there has been a marked decrease in real estate activity, resulting in the retention of a large proportion of real estate in the same ownership; hence the various assessments for public improvements have piled one on top of the other, while the same owners have been obliged to pay them out of earned incomes instead of from profits on sales. With the present condition of unemployment this has caused no little hardship, and, in too many cases, the actual loss of property. As a consequence, there has developed a strong demand from various sources, such as improvement associations and tax payers' leagues, for drastic modification of the assessment laws.

The principle of assessment of benefit goes back over 400 years. Practically all other states have such laws, which make cooperation of property owners possible and legal. In the vast majority of cases, the acts have worked satisfactorily; few property owners would go back to the old conditions for a refund of assessments already paid.

Ill-advised legislation might cause a throttling of all public improvements and injuriously affect the construction industry. Legitimate complaints are traceable to misapplication of acts and faults in administration, rather than to defects in the acts themselves. Scientific analysis and appraisal of existing acts by men familiar with their application is preferable to "cure alls" proposed by those not familiar with them.

Among abuses of existing acts may be mentioned "overlapping assessments." For these the petition system is largely responsible. The problem is simple in case of a storm drain system built piecemeal, but the complexity of different classes of improvements not built under one proceeding makes overlapping assessments difficult to avoid. As a cure for this abuse it is suggested that improvements be constructed under one proceeding where possible; that the economical soundness of each project be ascertained; that care be used in laying out assessment districts, and that suitable allocations from public funds be made.

In explaining overlapping assessments, the authors state: "The orderly sequence of consummation of the various features of a complete district improvement automatically brings the desire for, and the economic possibility of, the district improvement. In other words, the improvement of the street fosters developments on private property; after sufficient development on private property, ornamental lighting becomes desirable on certain streets; further intensive development on private property brings a density of traffic requiring the widening of existing streets or the opening of new ones. Later, parks, playgrounds, or a branch library is needed. Since it is impossible thus to improve a district completely at one time and with one assessment, it follows that the various developments must be accomplished by a series of assessments, pyramiding one over the other, constituting the so-called overlapping assessment."

"From the foregoing, it is quite apparent that the evils of the overlapping assessment cannot be eliminated by the enactment of new laws or by amending existing ones."

(Continued on page 67)

Building a Storm Drain with Ready Mixed Concrete

IN order to provide more adequate drainage for an extensive hilly area, the city and county of San Francisco, Calif., is constructing a storm drain along the old Ocean Shore railroad in the southern section of the city. The new Alemany Boulevard will be built over the new drain for a considerable part of its length.

The section now under construction, known as Section A, is 3,000 feet long, 8 feet 6 inches high, and 10 feet 3 inches wide. The walls are reinforced 12 inches thick, requiring 40.64 cubic feet of concrete and 227 pounds of reinforcing per linear foot. The bottom is paved with vitrified brick. The maximum aggregate is 1½-inch and 3% of Celito is used.

Concrete is being furnished by the Golden Gate-Atlas Materials Co., which operates a fleet of Paris Transit Mixers. The maximum haul is 2½ miles and each mixer averages ten trips per day. An average of 168 yards of concrete has been poured per day, representing a daily progress of about 110 feet. The contract called for completion in 210 days.

The Clinton Construction Company has the contract, the work being done under the direction of W. B. Brinker, president and general superintendent; the job superintendent is Theodore Petersen. The Alemany Boulevard Storm Drain is being constructed by the City and County of San Francisco under the personal direction of M. M. O'Shaughnessy, city engineer.

At the left, a section of the drain. At the right, above, pouring the invert, with side forms and reinforcing in place. At right bottom, laying lining on invert.

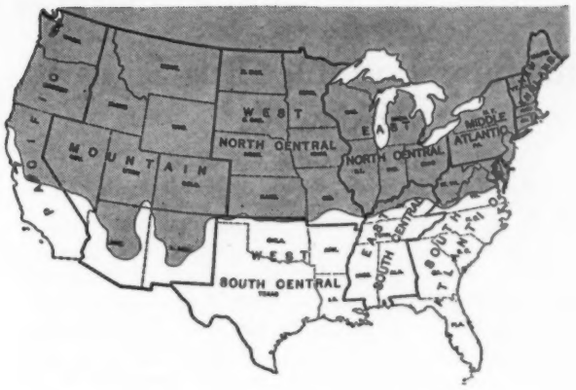
The Necessity for a Snow R

In the ruts and out of the ruts. That's life in winter where no attempt is made to remove snow.

These pictures show what happens when present-day heavy traffic is concentrated in ruts, or where piled up snow prevents drainage. Foundations are broken up or surfaces pounded to pieces.

Whether on country roads, or city streets, the taxpayer pays the bill that could have been prevented. Prompt and adequate snow removal preserves surfaces and lessens maintenance.

and Methods of Removal



General location of the "snow belt."

All over the "snow belt," shown at the right, engineers are faced with the problem of keeping roads open.

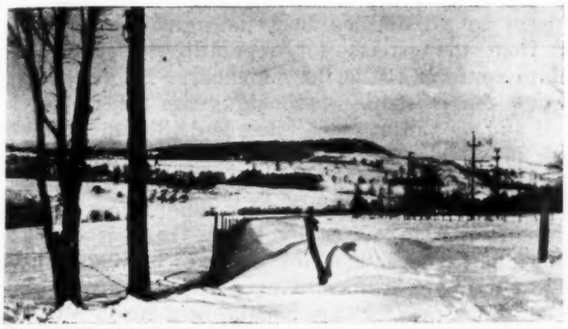
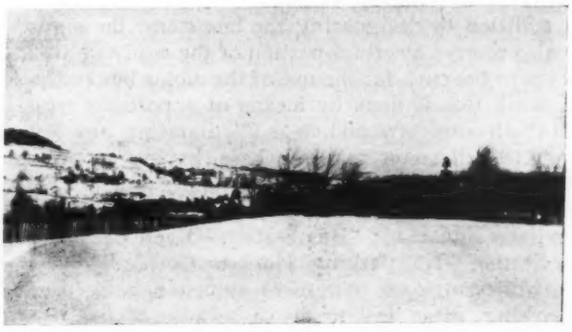


Photo by Nial Sherwood



Snow fences, above, alleviate the trouble but removal also is necessary. And promptly—snow should be removed before the sun melts it off. Adequate equipment and good organization are needed.

Removal work shown above is important in the city and in the country. Proper removal, as shown on the road at the left, distributes traffic and saves the road surface from concentrated and ruinous wear.

Other photos by La Plant-Choate, Caterpillar Tractor Co., and Carl Frink.

Attaching Portable Bus Signs to Sidewalk

By Chester Mueller
Principal Assistant Engineer, Bureau of Streets, Newark, N. J.

THE City of Newark, in common with every municipality, has the task of posting all necessary traffic, warning or other regulatory signs on the public streets. While most of such signs are the concern of the Police Department, the establishment and marking of bus passenger loading stations on the streets of Newark is the duty of the Department of Public Affairs. In this department, of which James W. Costello is the chief engineer, the work of marking such stations is carried out jointly by the Bureaus of Streets and of Transportation.

In addition to designating the bus stops, the signs must also reserve a certain portion of the roadway area adjacent to the curb for the use of the motor bus traffic. In Newark this is done by means of a portable sign 16"x14" in size, attached to a 2" diameter pipe set into an 18" diameter cast-iron base, having an overall height of 4'6" and weighing approximately 90 pounds. With black letters on a deep orange background the sign reads "Bus Station—Keep Clear" or "Bus Station—No Parking Here to Corner." These signs, while supposed to reserve space otherwise used for parking, often fail to do so because of the ease with which they may be moved. It has been the common experience of both the Bureau of Transportation and the Police Department to have such signs properly placed and spaced at the beginning of the day but to have motorists during the day move them by successive stages to shorten the reserved space. On many occasions a sign on a business street 100 feet away from a corner in the morning will be moved to make room for parking "one more" car so often, that, at the close of the day it will be at the corner.

To overcome this, the permanent placement of a sign is the remedy. A rigid post, however, concreted in the ground is objected to, on the following grounds:

First; when bus stations are relocated it would necessitate the reconstruction of a section of cement walk at both the former and the new locations, and of course a change could not be made as rapidly as with the portable signs.

Second; as such signs are placed adjacent to the curb at locations where buses are slackening speed preparatory to stopping, there is the danger that over-zealous passengers standing on the steps (contrary to department regulations, of course) will be struck by the immovable sign, such accidents having occured in the past.

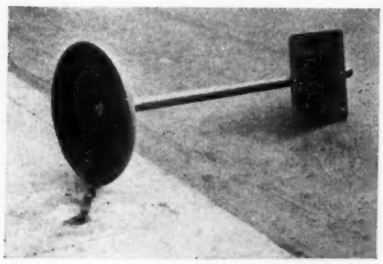
For certain locations, chains passed around the sign and the nearest available tree or utility company pole have been used. This method has its obvious disadvantages in that a fixed object is not always in the desired location and, when it is, it sometimes partially conceals the sign. Furthermore, the exposed length of chain does not contribute to the appearance of the sign.

During the latter part of 1930 a new method of attaching the portable signs to the sidewalk was inaugurated by the Bureau of Streets and has thus far proven so satisfactory that, as signs are withdrawn from the streets for repainting, they are altered to conform to the new manner. In the department's repair shop, where signs are taken for overhaul and repainting, a ¾" hole is drilled through the base midway between the center and the rim. Into this hole the 7/16" diameter shank of an eyebolt is welded so that the eye part is underneath the base, where, due to the cavity of the base, it does not interfere. The end of the bolt which shows on the top of the base is finished off flush with the surrounding surface so that after painting there is little visible evidence of the work. Either prior to, or after, forming the eye of the eyebolt, the blacksmith attaches to it an 8" length of chain. Separately, he makes up an anchor bolt which consists of ¾" stock with a ring at the top and which has a 6" x 6" x ¼" anchor plate slipped over the other end. Approximately one-half hour is required to prepare a portable sign in this manner.

The next step is the field work. The anchor bolt is concreted in the sidewalk, at the desired sign location, at a distance of about 18" from the face of the curb. The bolt is set deep enough so the eye portion is recessed in the sidewalk and no part projects above the surrounding surface. Should the sign location be abandoned, the anchor bolt can be left in place, offering no obstruction to pedestrian traffic. The sign is attached by bolting the end of the chain to the sidewalk anchor eye, the length of chain being just sufficient to permit the sign being laid on its side while this work is being done. When placed upright, the base of the sign entirely conceals all evidence of attachment and it appears innocent of all permanent moorings. So well is this illusion carried out that motorists have repeatedly parked adjacent to such signs, and with unconcern born of long experience grasped the sign prepartory to rolling it past their front bumper only to be startled to find the sign movement limited to half the diameter of its base.

One of the accompanying illustrations, of the first installation which was made by the Department of Public Affairs of Newark, shows the underside of the sign, the other picture shows the same sign in its normal up-right position.

Bus sign erect in place.



Method of attaching sign to sidewalk.

THE EDITOR'S PAGE

The Readers' Page

A considerable part of the matter found in the reading pages of PUBLIC WORKS, and the part that we at least appreciate most, consists of articles contributed by engineers, contractors and public works officials. We welcome these and can not receive too many of them.

Often, we believe, a reader has an idea which he would like to pass on to others interested in public works, but is too busy or too modest to develop it into an article, or perhaps it could be told adequately in a paragraph. He could, however, and perhaps would, write us a letter about it. We will in future publish such letters on a page (or more) which we are calling "The Readers' Page" and which will be found immediately following "The Editor's Page."

Here also we will be glad to publish comments upon articles we have published, requests for information, and replies to such requests.

In this first appearance of the Readers' Page we are publishing two letters endorsing or supplementing statements made in previous issues; and others sent in response to our request for suggestions on how to improve PUBLIC WORKS. While we are glad to receive appreciative comments, we are especially desirous of learning what our readers would like to find in this journal.

Augment Drought-Depleted Underground Water Supplies NOW

The long drought has been relieved over a large part of the country. During 1930 the rainfall deficiency over twenty or more states was between 20% to 50%. But crops and evaporation have a first call on rainfall, and the sub-surface supply receives only what escapes these and does not flow off over the surface, and it follows that the amount percolating underground may have been only 10% to 25% of normal, and the effect on ground water supplies has been quite serious in many sections of the country.

Where water supplies are derived from subterranean flows which originate at points so distant and pass through strata so slightly porous that several years elapse between the entrance of the water into the ground and its arrival at the well in question, the effect of the drought will be delayed and will probably be spread over so long a time as not to be serious. But where the supply is from porous sands or gravels or channels in limestone, the effect was felt quickly, and, on the other hand, previous conditions will be restored more rapidly when normal rainfall conditions return.

Even with the complete termination of continuous rainfall deficiency, it must generally be several months before the ground water rises to its previous level and delivers as much water as before. In fact, where wells were formerly being worked to their limit, if they continue to be so worked and effort is made to return to the same volume of withdrawal as soon as possible, the ground water cannot return to its former level unless after months or years of excessive rainfall. (This does not necessarily apply to small, shallow family wells, but only to those say 40 or 50 feet deep and supplying a community.)

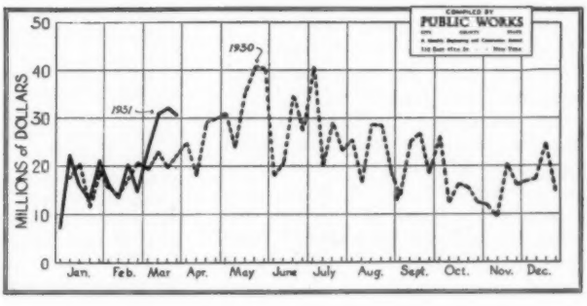
From this consideration of conditions it is apparent that plants using well supplies which have been pumping the maximum obtainable from their wells must not expect their troubles to be over as soon as a few "soaking rains" have fallen. Some may have to wait years before the wells will yield as much as before.

Meantime the community will probably be growing and the demand increasing, and it will be found that, even with normal ground water conditions restored, additional wells or a supplementary supply will be necessary by that time. It would seem to be the part of wisdom, where such conditions prevail, to so increase the well capacity or otherwise supplement the supply *NOW* that the supply will be adequate five or ten years hence under normal conditions, thus enjoying at once a capacity more nearly adequate for present needs, while the cost of the improvements would be less, in all probability, than it will be a few years from now.

The Tide Has Turned in Contracting

The March returns from the field of public works contracting indicate that business in this line has taken a decided upward trend. The curves shown below are plotted from reports received by PUBLIC WORKS, totaled by weeks, and include all branches of public work construction—Roads and Streets, Sewerage, Water Supply, Bridges, etc. These curves show that during January and February the totals were almost exactly the same as in 1930; but with the beginning of March a sudden jump took place, and up to March 26th the returns for that month exceeded those for a year previous by nearly forty percent.

The most rapid recovery has been in the fields of streets and roads, and bridges. Sewerage did not start its jump until the month was a third over but is coming on well. Water supply, on the other hand, began to develop strength by the middle of January, and by the end of February had passed the 1930 January-February record; it then took a drop, but the week ending March 26th shows a return to fairly satisfactory conditions.



THE READERS' PAGE

Licensing Engineers by Examination

The following letter which we received some time ago is self-explanatory. We have asked the New York State Education Dept. (which is in charge of the licensing of engineers and surveyors in that state) to give its views on the subject, and Mr. Steinman's reply follows:

In PUBLIC WORKS for January on page 17 I find an item under the caption "Fair Play" which ends in a paragraph asking for letters telling you what the writers think about the position of PUBLIC WORKS on the question of licensing engineers in New York State.

I take pleasure in telling you that I think that the position taken is absolutely sound and the advice given is good. I have been connected for more than seventeen years with an enterprise that is helping hundreds of thousands of young men into better careers. Most of these young men are non-college men and many of them with very little previous education are rising to positions of influence and usefulness without college education. Many of these positions are connected with engineering work, and repeated instances come to our notice where non-college men are taking great responsibilities in engineering enterprises and supervising the work of college trained men.

It doesn't matter so much where a person gets his education, provided he gets it and has the good sense to use it correctly. I believe the Engineering License Commission of New York State is "off on the wrong foot" as it were. I have just read a pamphlet headed "Supplement to Handbook No. 36" dated August, 1930, telling about the requirements for obtaining a license as a professional engineer and a land surveyor in New York State. According to that pamphlet no non-college man need apply. As a matter of fact, college trained men would be confronted with a hopeless situation if they were obliged to take the examination. I think there would be very few exceptions to this last statement. Very truly yours,

D. E. CARPENTER, Dean.
International Correspondence Schools

Boquet for Refuse Review

Editor of PUBLIC WORKS
New York City.

I want to thank you for the exceptionally fine review of my paper on the "Combustion of Organic Wastes" in the March issue of PUBLIC WORKS.

While this paper has been abstracted and extracted by a number of engineering and municipal publications, including the ————, you have chosen the more difficult course of preparing a concise review and in so doing you have clearly expressed it. I am certain that I could not have done it myself as fairly, clearly and concisely as you have.

There will be further publications on the balance between net heat and the total heat in the gaseous products of combustion at 1210 deg. fahr. for varying proportions of garbage and rubbish. When the net heat is not sufficient to heat the products of combustion to 1210 deg. fahr., such mixtures are incombustible and can not be burned without auxiliary fuel.

The steam generating data are of secondary importance at present, because, once the thermal properties and quantity of fuel are given, it is a comparatively simple matter for a competent combustion engineer to figure out the rest.

Very truly yours,
E. E. BUTTERFIELD.

Dear Sir:

The policy of requiring educational qualifications for the licensing of professional engineers should require no apology or defense. The only objectors are would-be engineers who lack the proper training, and would-be engineering schools that cannot meet the minimum requirements for official registration.

Engineering is a learned profession, not an apprenticeship. It requires more intensive study and training than any other profession. For the protection of the public, no man should be licensed to practice engineering unless he has equipped himself with the preliminary and professional education commensurate with the modern requirements of engineering practice.

To verify the educational qualifications of the men who have graduated from established engineering colleges is comparatively simple. The official registration of the college records the acceptance of its curriculum and educational standards, and the degree conferred is evidence that the candidate has successfully passed the courses and examinations covering his professional training.

To verify the educational qualifications of those who are not graduates from recognized engineering colleges, the only method available to the licensing boards is by giving professional examinations. Without such examinations, the door would be shut to the non-graduate. The ambitious young man who has endeavored to make good his lack of professional education by enrolling in correspondence schools or in night schools surely should not object to a procedure that gives him an opportunity to show that he has the equivalent of the college graduate's training.

New York is not the only State, and engineering is not the only profession, to require examinations as a prerequisite for admission to practice. The principle is well established. Correspondence schools would not get very far if they attacked this procedure in other professions, and they should cease their efforts to pull down the standards of the engineering profession.

Night schools and correspondence schools do not take the place of recognized colleges of engineering, but perform a useful function in training young men for sub-professional work, as tracers, draftsmen, surveyors, etc. They should not mislead their students into believing that they are getting a full and adequate professional training. Occasionally a young man of exceptional ability, after such limited training, qualifies himself by further study, observation, and experience, for advancement to professional standing. To him, the door is open through the prescribed examinations and the other qualification requirements.

The apprehension that the examinations given by the New York State Board are prohibitively difficult is without basis in fact. The examinations have been written so that they can easily be passed by any graduate engineer five or ten years after graduation. Fifty per cent of the non-graduates who have taken these examinations have passed them successfully.

If legislation now pending is enacted, the examinations will, after a certain date, be required of graduates as well as of non-graduates. This will be in conformity with the established admissions procedure of the other learned professions.

The profession has to protect the public safety and its own standing against the practice of the untrained or the half-trained. To this end, licensing has been established by law; and to the same end, the qualifications for licensing must include proper educational requirements.

Yours very truly,
D. B. STEINMAN,
Vice Chairman, N. Y. State Board of Licensing for Engineers.

Suggestions From Our Readers

Articles dealing with the every-day kinks in Municipal Engineering are interesting—more so than descriptions of big projects, which are usually only general in nature.

I would like to see some articles on "Standards" as used in city engineers' offices, such as standard symbols used on water, sewer, and paving plats; methods of filing and keeping records; house numbering systems; methods of handling field inspection and reports on same; inspection of sewer connections; defective sidewalks, etc.

J. M. POWELL, City Engineer, Elyria, Ohio.

I would like to see more articles on methods and devices for keeping municipal engineering records, articles on design like that of C. R. Spencer in January, 1930 issue, and in general more articles that have a bearing on every-day problems in municipal engineering.

G. E. HEEBINK, City Engineer, Beloit, Wis.

Number of Contractors in the United States

THE Bureau of the Census is collecting information concerning contract work and the contractors in the several states, which will be published when completed. Some preliminary figures have been given out as of January fifteenth, although reports were still continuing to come in.

These preliminary figures showed 122 contractors per 100,000 population of the country as a whole, but only 28.3 of these did a business of $25,000 or over in 1929. The totals for the United States were 149,798, of which 34,794 reported business of $25,000 or over in 1929.

From the table it is seen that contractors doing $25,000 or more of business a year constitute about 45% of the total in North Carolina, 37% in District of Columbia, 32% in Delaware, 30% in Alabama, Georgia, Illinois, South Carolina and Tennessee, while of those in Idaho only 11% come in this classification. The largest number was found in New York—21,277 total and 6,160 in the "big" class, while California came second, with 14,811 total, but Pennsylvania was second in the "big" class, with 2,986. On the per capita basis Connecticut leads with 302.7 per 100,000 total, and District of Columbia in "big" fellows, with 63.7 per 100,000. Mississippi reported only 22.9 total per 100,000 and 5.2 "big" ones.

Quicklime for Stabilizing Bleaching Powder

Experience in British India is said to have demonstrated that addition of 20% dry quicklime to bleaching powder causes it to remain dry in hot climates and not to corrode tin, but the mixture deteriorates more rapidly at all seasons than simple chloride of lime.

State	Total No. of Reports Received	Number Reporting Business Amounting to—$25,000 and Over		Number Reporting per 100,000 Population	
		Number	Per Cent of Total	All Contractors	Contractors Doing Business $25,000 and Over
UNITED STATES	149,798	34,794	23.2	122.0	28.3
Alabama	628	192	30.6	23.7	7.3
Arizona	358	105	29.4	82.3	24.1
Arkansas	648	125	19.3	34.9	6.7
California	14,811	2,763	18.7	261.0	48.6
Colorado	1,490	197	13.2	144.0	19.0
Connecticut	4,862	860	17.7	302.7	53.4
Delaware	275	88	32.0	115.4	37.0
District of Columbia	836	310	37.1	171.7	63.7
Florida	1,473	253	17.2	100.5	17.2
Georgia	683	206	30.2	23.5	7.1
Idaho	325	36	11.1	73.1	8.1
Illinois	9,672	2,904	30.0	127.0	38.0
Indiana	3,757	776	20.6	116.0	24.0
Iowa	3,198	485	15.2	129.6	19.7
Kansas	1,616	325	20.1	86.0	17.3
Kentucky	1,659	356	21.4	63.5	13.6
Louisiana	830	218	26.3	39.5	10.4
Maine	893	147	16.5	112.0	18.4
Maryland	2,279	441	19.4	139.9	27.1
Massachusetts	7,129	1,654	23.2	168.0	39.0
Michigan	7,274	1,599	22.0	150.0	33.0
Minnesota	2,922	685	23.4	114.0	26.8
Mississippi	461	104	22.6	22.9	5.2
Missouri	3,076	854	27.8	84.8	23.6
Montana	523	140	26.8	97.4	26.1
Nebraska	1,367	267	19.5	99.4	19.4
Nevada	155	23	14.9	170.3	25.3
New Hampshire	758	128	16.9	163.0	27.5
New Jersey	8,697	1,718	19.8	215.0	42.4
New Mexico	230	46	20.0	54.3	10.9
New York	21,277	6,160	29.0	169.0	48.9
North Carolina	670	300	44.8	21.1	9.5
North Dakota	537	111	20.7	79.0	16.3
Ohio	9,304	2,331	25.0	140.0	35.1
Oklahoma	1,189	324	27.2	49.5	13.5
Oregon	1,330	273	20.5	140.0	28.6
Pennsylvania	14,292	2,986	20.9	148.4	31.0
Rhode Island	1,226	239	19.4	178.5	34.7
South Carolina	413	123	29.8	23.8	7.1
South Dakota	449	82	18.3	64.8	11.8
Tennessee	1,353	404	30.0	51.7	15.5
Texas	3,984	1,098	27.8	68.4	18.8
Utah	867	146	16.8	170.5	28.7
Vermont	340	64	18.8	94.8	17.8
Virginia	1,204	329	27.4	49.8	13.6
Washington	1,916	426	22.2	122.8	27.2
West Virginia	982	198	20.2	56.9	11.5
Wisconsin	5,413	1,155	21.4	184.2	39.3
Wyoming	217	40	18.4	96.4	17.7

Protect Water Supplies Against Spring Freshet

The state department of health of New York is advising water works officials to take every precaution to prevent possible contamination of the public water supplies under their control that may arise from the usual spring freshet and flood conditions. The unusually low rainfall in many sections during the past year has caused low stream flows with increased concentration of pollution. During the usual spring rains, polluted material will be washed into tributary watercourses and, under the influence of rapid stream flow, carried to public water supply intakes comparatively quickly. Consequently, the danger of contamination of public water supplies will be great.

Watersheds should be carefully inspected now and any possible sources of contamination removed. Water purification plants should be thoroughly examined and placed in perfect operation so that they may be ready to meet any extra burden placed on them during spring freshets.

If, in spite of these precautions, the purity of any water supply is endangered, the state board of health should be notified at once by telephone and telegram in order that it may give advice for the protection of the supply. Several of the states are prepared to install temporary chlorination plants in such emergencies.

Spur Roads From Through Routes

In a discussion of spur roads by the A. R. B. A., Chas. F. Boehler, engineer of design, Michigan Highway Dept., stated some general principles that are condensed below:

The desire generally entertained a few years ago by cities and villages that highways be carried through their main business streets has changed considerably. Especially the larger communities have found that this location of a main highway causes congestion in its business district, interferes with the business of the abutting stores, causes danger from the traffic rushing through, and involves expense for widening and frequent repairing of the roadway.

Through traffic also desires to avoid the congested business districts. Even though a detour around a city may lengthen the distance, it may at the same time shorten the running time from one side of the city to the other.

But this by-passing of the city does not favor traffic wishing to enter it. To accommodate these and save local and inter-city traffic, spur roads may be located to lead from the main highway to the center of the city, built and maintained as a part of the trunk line system. This combination of through routes and spur roads best serves both through and local traffic.

Lighting a Swimming Pool

THE Rouge Park swimming pool, illustrated herewith, is one of the pools owned and operated by the city of Detroit, Mich. The lighting of this pool is of special interest. It is equipped with both surface and subsurface lighting.

This installation of underwater lights and outside floodlights is of unusual interest because it is one of the few fully lighted outdoor pools and because of its large size. It measures 165 feet long by 70 feet wide. The underwater illumination is produced by thirty-six 250-watt Aqualux underwater lights. These are distributed along the sides of the pool in two rows, one row at the top and a second row at the bottom, beginning about one quarter of the way down from the low level. These underwater units are installed in cast aluminum housing set in the concrete. A conduit runs from each housing to a junction box at the top of the pool. Since the lighting units are not permanently fastened to the concrete and since each light is furnished with extra cord, it is possible to remove the entire unit from its housing and take it to the surface for relamping or servicing. Type G-30 floodlight lamps are used for all the Aqualux underwater lights.

For the surface illumination of the swimming pool and for the lighting of the surrounding grounds thirty 1000-watt Chromilite floodlights are used. These are mounted in groups of three on 40-foot poles located around the edge of the pool. One of these floodlight batteries placed on the bath house helps illuminate the surrounding territory.

The lighting equipment was furnished by the Westinghouse Electric and Manufacturing Co.

THE WATER WHEEL

By
Jack J. Hinman, Jr.

For Water Works Men

The essential features of important articles of the month having to do with water works design, construction and operation and water purification, arranged in easy reference form and condensed and interpreted by a leader in the water works field. Published every month to include articles appearing during the preceding month.

Design

PREPAREDNESS for disasters requires careful planning on the part of water works operators, even in areas where slippage along faults is not to be feared[45]. In areas where earthquake faults exist, it is most important that these shall be known, and their direction, location and degree of activity ascertained. Long supply lines must be kept on solid ground and as far away from faults as possible. The new pipe line to San Francisco from Lake San Andres must of necessity lie close to the San Andres fault line, but is laid in what is believed to be the line of least disturbance. In the past, rigid pipe lines have suffered more than those that could move slightly when disturbances have taken place. Expansion joints, proper depth, and a sufficient number of gate valves help to avoid damage to the line and to the continuity of the supply. Well trained personnel of emergency crews, men who know what to do if breaks occur, and provision of adequate telephone lines for communications to distant points are essential to avoid interruptions to service.

It has been suggested that additional stability is secured by tying the sides of rectangular **reservoirs** together with well-reinforced cross walls. This makes for structural stability and also allows compartments to be formed which permit cleaning the reservoir in sections, without throwing it entirely out of service.

The design of **intakes** and **screens** for gravity water supplies which derive their water from streams in the Northwest, deserves more attention than it has usually received, according to John W. Cunningham[34]. In forested regions the fall of leaves in the autumn brings such quantities of material to the screens of these plants that clogging is frequent and the attention necessary to clear the screens may become very burdensome. Booms are used to deflect floating debris from the intake. Storage above the intake will reduce troubles from turbidity by allowing sedimentation. The actual intake should be above the bed of the stream in order to avoid entrance of sedimentary matters, but it should be located in the deepest available water. Continuous-cleaning screens are very satisfactory but are generally limited to the larger plants on account of their size and cost. However, several schemes can be used to permit of more or less automatic removal of the debris if a portion of the diverted water can be spared for the purpose of flushing.

Earthen embankment masonry-lined **reservoirs** and their design have been discussed by Chester A. Smith[44], who also supplies cost data and other particulars about a number of structures of this type. The interior walls of these reservoirs generally slope not less than 1½ to 1 which is about as steep an angle as a reinforced concrete slab can be placed without forms, or without causing slumping. An angle of 2 to 1 is better where the walls are high. The outside may be 1½ to 1, 2 to 1, or 2½ to 1 according to the circumstances. Clay and sand mixtures are found to be best for the embankments. Silt and volcanic ash are very treacherous on account of their tendency to flow when wet. Any sudden change in the character of the supporting earth will require immediate consideration and may require a change from the original design. Outlet and inlet pipes should be laid in trenches in the original firm soil, with concrete cradles to support them where they pass beneath the embankments. Collars and cut-off walls at right angles to the pipe and 20 to thirty feet apart are desirable. Pipes should have collars at the points where they enter embankments. Reinforcing steel to the extent of 0.2 to 0.4% of the cross section of the slab is used. Underdrains help to detect any leakage, if placed so that the discharge of the drains can be observed. Expansion and construction joints, water proofing, storm drainage and provisions for overflow, all demand careful study.

In drawing the specifications for **wells** H. O. Williams[2] recommends that the engineer shall insert a statement as to the permitted draw-down that the well shall show when water is delivered at a specific rate. It is contended that, unless the engineer does this, there is a tendency not to develop the well as thoroughly as should be done and to pump the well practically dry in the endeavor to secure the required volume of water. Wells so tested will not yield up to their reputed capacity in many cases when put into actual service.

A main under railroad tracks was laid under an arrangement with the railroad company whose tracks were to be crossed by a new 24-inch main laid parallel to an existing 16-inch main, whereby both mains were placed in a concrete box culvert of sufficient size to allow easy working[56]. Manholes on both sides of the track and a drain with outlet subject to observation were installed.

In general, water authorities would prefer that all connections between **electrical circuits and water pipes** be prohibited. In Los Angeles[27,51] the grounding of telephone cable sheaths to water pipes has been permitted in the interest of reducing the noises in telephone equipment. Except in areas served by electric street railways where corrosion may take place, it is

held that no harmful effect on the water piping is produced.

A new formula for **friction losses in steel pipe** has been proposed by F. C. Scobey, of the Bureau of Public Roads[18]. The formula is:

$$H = Ks \frac{V^{1.9}}{D^{1.1}}$$

Where H is the loss of head due to friction in feet per 1000.

Ks is a coefficient depending on the thickness of the plate and the type of jointing,

V is the average velocity in feet per second, and

D is the diameter of the pipe in feet.

The formula is similar to the Hazen-Williams formula which may be transformed into:

$$H = K \frac{V^{1.852}}{D^{1.167}}$$

and to the Weisbach, or Chezy formula, $H = K \frac{V^2}{D}$.

A new water softening plant with **double carbonation** and filtration recently has been completed and put into service in Cedar Rapids, Iowa[47]. The plant has a rated capacity of 12 million gallons, the anticipated maximum daily demand of the city in 1940. The plant includes a low-lift pump station operated by remote control from the high-service pumping station and filter plant 4500 feet distant. The low-lift station contains centrifugal pumps of 5, 7½, and 10 million gallons capacity. All are motor driven, but the 10 mg. pump may also be run by a gasoline engine. The high service station pumps are 4.5, 7.5 and 10 million gallons capacity motor driven centrifugal pumps, of which one, the smallest, can also be driven by a direct-connected gasoline engine. The purification equipment consists of aerators of the Sprayco type. Premixing basins of 2-minute detention, provided with baffles and air agitation, receive the raw water and chemicals. The water then passes to mixing basins of the revolving paddle type, and thence to sedimentation basins having a capacity of two hours flow at the full rating of the plant. They are of the Dorr type, though but one basin is furnished yet with the moving mechanism. Carbonation is possible in a flume between the two sedimentation basins and also in a special carbonation basin with 20-minute capacity into which the effluent from the second Dorr unit is discharged. The carbon dioxide needed is produced in an oil-fired furnace, which also serves to heat the plant. There are four filters of 3 mgd. each, the equipment for which was supplied by the International Filter Company. From the filters the water is run to a 600,000 gallon reservoir in which the high service pumps take suction. An 8,000,000 gallon reservoir "floats on the system."

A smaller **water softening** plant operating on much the same basic principles has been built for Dundee, Michigan[46]. It has a capacity of 600,000 gallons per day. An activated carbon unit to operate by upward flow at a rate of 10 gal. per sq. ft. per min. is provided.

The history of **Minneapolis' water treatment** equipment is discussed by C. C. Wilbur[30]. In 1913 the 39 mgd. Columbia Heights plant was put into service. Later its capacity was doubled. In 1923 work was begun on the Fridley plant, which was designed to be built in four units of forty million gallons each. One of the four units has been installed, giving a total capacity of 118 mgd. A second unit will soon be put in service.

The **water supply of Saint Paul,** Minnesota[29], came for years from a chain of 14 lakes; but during a dry year, in 1910, 34 wells were drilled to an average depth of 600 feet to increase the available supply. These wells yielded 16 mgd. In 1911 the rainfall returned to normal and the lakes were filled; consequently the wells have been used infrequently since that date. In 1920 it was decided to increase the supply by taking water from the Mississippi river at a point 6 or 7 miles north of Minneapolis and pumping the water to the upper end of the chain of lakes through the Fridley conduit, the capacity of which was originally planned to be 40 mgd., but later 60 mgd. was decided upon. The conduit is of coated steel pipe for the first 8150 feet and the balance is of reinforced concrete poured in place, the invert being poured separately from the crown. Springs, quicksand and peat bog made construction difficult. Joints 20 feet part were constructed using a copper ring. A V-shaped groove in the pipe just inside the ring was filled with asphalt. Leaking joints were later repaired from the outside by covering with an 8-inch plate and tamping in concrete from the edges, and filling the center portion of 2 inches with roofing cement by means of a grease gun. In 1925 a 4½-mile 90″ conduit was constructed with joints 40 ft. apart, using a beaded copper ring set in a deep recess ⅜″ wide in each pipe and filled with roofing cement, which has proved to be a satisfactory joint.

About 500,000 evergreens have been planted by the water department of St. Paul since 1914. The plantings have suffered considerably at the hands of the public, but some trees are now 15 feet high. Tastes and odors in the water have been combated successfully by aeration produced by forcing through the water 6000 cubic feet of air per million gallons at five pounds pressure. Pipes and service connections must be laid deeply to avoid frost, 8 feet cover being common. Copper service pipes are preferred for services 2 inches and less in diameter.

Manhattan, Kansas[36], gets its water from four wells which have considerable hardness and a high free carbon dioxide content. Recarbonation was installed in 1929 and permits still better results than formerly.

Montclair, N. J.[1], is the first of eight cities to be supplied with water from the Wanaque water development, which is brought from a 29,000 mg. reservoir 25 miles to the city through twin pipe lines. Additional elevated storage and booster equipment have been installed by the city.

A **booster** station for the Hilltop section of Columbus, Ohio[8], failed to deliver the water desired. **Cleaning** the 20-inch suction line so improved the delivery that other pipes in the vicinity, which contained calcium carbonate deposits, were cleaned. Toronto[13] has built a new booster station for the Riverdale district.

Van Wert, Ohio[9], installed additional **elevated storage** to improve the pressure in the distribution system. The overflow of the new tank was set three inches above that of the old tank so that the old tank will overflow first.

Purification

The water supply of the Southend Water Company at Langford, England, is purified by the excess lime method of treatment[35]. The raw water is divided into two portions, one-sixth of the supply being treated with sufficient lime to give an excess of 2 grains per Imperial gallon to the entire volume of raw water.

(Continued on page 71)

Asphalt Fillers for Brick Pavements*

Asphalts of relatively high melting point possess relatively low ductility. Uniform joint spaces about one quarter inch wide permit use of the most satisfactory fillers.

IT IS reasonable to assume that uniformity in width of joint space is highly desirable, but at the present time, in the lugless brick pavements as laid, the joint space varies from 0 to somewhat more than ⅛ of an inch in width, and in the lug brick pavements, from ⅛ of an inch to somewhat over ¼ of an inch.

Ordinary asphalt as applied hot is a viscous liquid which, as it becomes chilled by contact with the relatively cold air and brick surfaces, rapidly increases in viscosity until it becomes semisolid. It must therefore find its way quickly into the joint spaces if it is to serve its primary function.

There are two general types of asphalt, steam refined and oxidized. If of the same degree of hardness at normal temperature, the former maintain their fluidity for a longer period after application than the latter. In other words, at elevated temperatures considerably lower than that of application, they are much more fluid than the oxidized asphalts. They will, therefore, find their way into extremely narrow joint spaces more readily than the oxidized asphalts, and to this extent might seem preferable. As a corollary of the relative viscosities of these two types of asphalt at elevated temperatures, however, the steam refined asphalt becomes softer in hot weather and therefore more likely to bleed, and it also becomes more brittle in cold weather and therefore more likely to chip. If, therefore, the oxidized asphalt can find its way into the joint spaces, it possesses certain advantages over the steam refined product.

If sufficiently fluid when they come in contact with the joint faces, both types will adhere firmly to the brick and thus waterproof the joint. As the steam refined asphalt maintains its fluidity for a longer time after application, it has, however, a better opportunity to adhere to the brick faces in narrow joints and to this extent is again preferable.

In refining any asphalt to a given penetration at normal temperature, the melting point of the finished product is raised in proportion to the amount of oxidation which is permitted to take place. The same is true of its viscosity at relatively high temperatures and of its lack of susceptibility to ordinary ranges of atmospheric temperatures. Its ductility at normal temperature on the other hand is reduced very materially in the later stages of oxidation. It therefore follows that asphalts of relatively high melting point possess relatively low ductility.

When wide-joint brick pavements were more commonly laid, such highly oxidized asphalts were undoubtedly the preferred type of asphalt filler. As the narrow-joint, lugless brick, came into more general use, however, it was found more difficult satisfactorily to fill the joints with these very high melting point products. Specifications therefore have been modified with the hope, on the part of many engineers, that some asphalt might be obtained which would possess all of the desirable characteristics of both steam refined and highly oxidized products and none of the undesirable characteristics of either—a rather hopeless proposition.

The speaker believes that the present asphalt filler specifications of the American Society of Municipal Engineers and of the Brick Association represent about as satisfactory a compromise as is likely to be reached under existing construction specifications, and that further improvement must come from realization that to obtain best results with an asphalt filler, reasonably wide and uniform joint spaces must be provided. At this time, the lug brick most nearly insures these conditions, but by suitable methods of laying, possibly with the use of temporary spacers, lugless brick may be equally satisfactory. This is a construction detail which comes strictly within the province of the engineer. *If he would devote more time to seeing that his pavement had uniform joint spaces to fill rather than to condemning the character of fillers, it is believed that present problems would soon be solved.*

Given a reasonably uniform joint space with a minimum width of 3/16", it is believed that two types of asphalt filler will be found quite satisfactory. For a poured joint filler, an oxidized asphalt with a somewhat higher minimum melting point than now permitted, should be used. For a squeegee filler, an asphalt grout, composed of a mixture of steam refined asphalt and sand, similar to that now commonly used in the construction of granite block pavements, should prove satisfactory. The latter has been used successfully by the City of New Orleans with lugless brick. Addition of fine mineral matter to an asphalt produces an effect somewhat similar to raising the melting point of the asphalt alone. In a grout, therefore, it is practicable to use a softer and lower melting point asphalt than if the straight asphalt were to be used alone.

Both suggested types of filler, properly applied, should readily fill joint spaces of the width mentioned, waterproof the joints and provide for ordinary expansion and contraction. Whether or not the engineer wishes to protect the pavement with a carpet coat would determine his selection of type of filler.

Bituminous Sand Cushions.—It would seem that, if the ordinary sand cushion could retain just sufficient moisture to prevent it from displacement after the brick had been thoroughly bedded, it would prove entirely satisfactory. As it loses its moisture, however, it also loses stability. While admitting that he has not actually put the idea into practice, the speaker believes that if the cushion sand is first thoroughly dried and then mixed with almost any non-volatile residual oil of about as high viscosity as can be mixed cold, in such proportions as to produce the consistency of a slightly moist bedding, such as the paver prefers, sufficient permanent stability will be developed to overcome all of the faults of the ordinary sand cushion.

* Slightly condensed from a discussion by Prevost Hubbard, chemical engineer, The Asphalt Institute, before the National Brick Manufacturers Association.

Itemized Costs of Public Works in Norwood, Mass.

By C. A. Bingham
Town Manager of Norwood, Mass.

THE town of Norwood, Mass., had a population of 15,049 by the 1930 census. The total expenditures of the Public Works Department of Norwood during a calendar year average about a third of a million dollars. This figure of course includes the maintenance and operation of all its divisions as well as the work performed for other departments. Of this total sum, nearly one half is expended on new construction, in addition to regular maintenance. The tables give the details pertaining to 72 separate jobs totalling $128,260.02.

Much interesting information may be secured from a careful analysis of these cost data. For example, we discovered that the percentage of money expended for labor varies much according to the cost of the materials entering into the various types of construction. The highest is in sewer construction, where 72% is for labor; next is cement sidewalk work, with 67%, drains 52%, water mains 42%, and highway construction with only 31%, on the average, going to labor payroll.

The comparison of preliminary estimates with final actual costs is likewise interesting. In all the 72 jobs, the estimates were reduced by $5,335.14; in other words, the season's construction work was done for 95.66% of the estimates. Only one method of doing work is allowed in this department, and that is the old slogan of "the best is none too good."

The general average of cost of all sizes, including all hyrants, valves, manholes, special street adjustments, rock blasting, tree removals and new steps, overhead, engineering, etc. for the year were as follows:

Water mains	$2.19	per	foot;	average of	8,722	feet on	15 jobs
Sanitary sewers	3.08	"	"	"	7,623	" "	19 jobs
Drains	3.38	"	"	"	4,856	" "	12 jobs
Highway construct.	1.33	sq.	yard	"	39,942	sq. yds.	21 jobs
Cement walks	1.93	"	"	"	3,685	" "	5 jobs

On the costs of trench excavation, it was found that earth and gravel work ran from 80 cents to $2.81 depending on water conditions and sheeting requirements, the average of 22 jobs being $1.56 per cubic yard.

The cost of rock excavation in trenches on 15 jobs, totaling over 1200 yards of rock, was $6.48 per cubic yard; the individual costs running between the extremes of $4.86 and $10.60, largely depending upon the size of the job. On nine jobs where an average amount of blasting was necessary, the costs of rock removal were in every case within one dollar of the average price. With the exceptions of injury to other pipes either lying on the rock or very close to it, or to pipes frozen into the same earth stratum, there were no damages caused by all this blasting.

As labor and material prices enter so deeply into construction costs, it is well to give some of these in this statement: Labor 60 cents an hour; foreman, $6.00 a day. Municipal trucks, 50 cents to $1.00 an hour; hired trucks, $1.50 to $2.50; gasoline, 8½ cents; oil, 50 cents. Joint compound, 9 cents; jute, 14 and 24 cents, Road oil applied, 5¼ cents, penetration 7.4 cents a gallon. Sewer pipe, 5"—12½ cents, 12"—37.8 cents. Water pipe, 6"—57 cents, 8"—81 cents foot. Crushed stone, $1.72 to $2.20 a ton; gravel, 60 cents a ton.

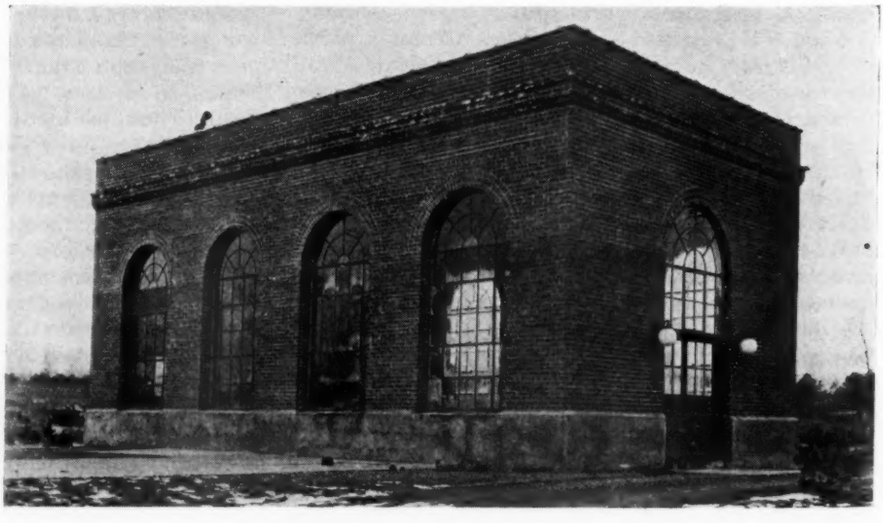
The tables referred to above will be found on pages 47 and 48.

New Wells, Pumps and Storage for Water Works System of Scotia

(Continued from page 27)

cost of the work, together with interest charges during construction and various miscellaneous accounts, with all engineering, land and rights-of-way charges, represents about $174,000.

Six months' use of the plant has saved the village from a critical water shortage. The attendants at the pumping station have been reduced from three to one. High-duty pumping is now done on off-peak periods at a cost of one cent per KWH. A much needed storage capacity has been supplied; and well and pumping equipment which had given some twenty-five years of service have been replaced with equipment of larger capacity, greater efficiency and of design which makes possible a considerable saving in yearly maintenance.



View of new pumping station.

Cost Data on 1930 Construction by the Department of Public Works, Norwood, Massachusetts

Quantities	Labor	Rollers, Trucks and Compressor	Principal Materials	Other Materials	Overhead and Engineering	Total Cost	Unit Cost	Budget Estimate	Departure from Estimate	Remarks
Oiled Gravel										
1,198 sq. yds. 6" surface	315.06	266.00	656 cu. yds. gravel, $393.60; 3,000 gals. oil, $159.00	3.62	90.98	1,228.26	1.03	1,444	— 215.74	Hauling gravel cost 27c cubic yard.
1,965 sq. yds. 6" surface	990.78	531.00	480 cu. yds. gravel, $288.00; 3,206 gals. oil, $168.31	619.44	207.80	2,805.33	.91 Net	2,875	— 69.67	Unit price does not include 36" culvert costing $704.
1,090 sq. yds. 6" surface	174.82	57.00	343 tons stone, $426.61; 1,806 gals. 65% oil, $97.68		60.45	816.06	.75	776	+ 40.06	Stone base, gravel top.
926 sq. yds. 6" surface	827.08	383.75	507 cu. yds. gravel, $301.20; 1,000 gals. oil, $54.00		129.71	1,695.74	1.19 Net	1,166	+ 532.54	Includes $382 rough grading.
978 sq. yds. 6" surface	1,042.71	354.00	555 yds. gravel, $333.00; 4,000 gals. oil, $213.00	54.10	159.74	2,156.55	1.89 Net	2,134	+ 22.55	Total cost includes $115 gravel walks.
1,382 sq. yds. 6" surface	623.16	917.75	595 yds. gravel, $357.00; 4,000 gals. oil, $213.00	58.80	173.58	2,343.29	1.52 Net	2,508	— 164.71	Total cost includes $117 gravel walks.
1,240 sq. yds. 6" surface	295.90	172.00	289 tons stone, $375.74	174.92	81.48	1,100.04	.89	2,235	—1,135.04	Subgrading only cost 15c sq. yd.
1,300 sq. yds. 4" scarified	270.04	137.00	1,500 gals. oil, $81.00	97.20	46.82	632.06	.49	1,512	— 880.06	Only needed scarifying and reshaping.
3,970 sq. yds. 6" surface	1,788.78	1,144.50	6,412 gals. oil, $346.24; 203 loads fill, $406.00; 227 tons stone, $446.49	236.18	349.46	4,717.65	1.19	3,240	+1,477.65	Includes $1,600 of extra sidewalk and loam work.
1,179 sq. yds. 6" surface	216.90	236.00	4,706 gals. oil, $255.82; 345 yds. gravel, $207.00	1.62	73.38	990.72	.84	1,253	— 262.28	
Bituminous Macadam										
4,011 sq. yds. 6" penetration	1,519.47	793.00	1,041 tons stone, $1,755.56; 10,650 gals. asphalt, $788.10	98.61	396.38	5,351.12	1.33	Part of $12,000 Resurfacing		Includes $171 of drainage work.
6,180 sq. yds. 6" penetration	2,704.91	860.25	1,805 tons stone, $3,516.89; 17,100 gals. asphalt, $1,265.40	401.94	699.95	9,449.34	1.53	8,208	+1,241.34	Includes $757 of drainage work.
1,812 sq. yds. 4" penetration	468.04	151.50	351 tons stone, $744.13; 4,500 gals. asphalt	333.00	200.59	1,897.96	1.05	2,592	— 694.04	Includes $70 for extra engineering.
3,150 sq. yds. 4" penetration	917.55	300.50	596. tons stone, $835.01; 8,600 gals. asphalt $636.40	2.62	215.37	2,907.45	.92	2,808	+ 99.45	Subgrading ran 25c per sq. yd.
1,590 sq. yds. 6" penetration	1,774.49	533.75	940 tons stone, $1,132.42; 5,500 gals. asphalt, $407.00	510.26	348.63	4,706.55	2.24 Net	3,726	+ 980.55	Includes $1,411 on rock removal and $512 on building walks.
690 sq. yds. 6" penetration	428.54	168.50	386 tons stone, $423.42; 2,100 gals. asphalt, $155.40	123.65	103.96	1,403.47	1.27 Net	2,367	— 963.53	Unit price on yardage does not include sidewalks.
2,045 sq. yds. 6" penetration	1,205.59	288.75	15,370 gals. oil, $1,137.38; 791 tons stone, $1,719.81	3.32	348.39	4,703.24	2.30	Part of $12,000 Resurfacing		
1,855 sq. yds. 4" penetration	397.80	133.25	5,000 asphalt, $370.00; 291 tons stone, $609.24	14.38	121.97	1,646.64	.89	Part of $12,000 Resurfacing		
914 sq. yds. 6" penetration	917.51	417.00	1,000 gals. oil, $54.00; 368 yds. gravel, $220.80	29.74	131.16	1,770.21	1.53 Net	1,642	+ 128.21	Total includes $286 tree and sidewalk work.
Bituminous Gravel										
2,070 sq. yds. 6" penetration	833.44	316.75	970 tons stone, $1,334; 5,000 gals. asphalt, $370	408.68	448.45	3,711.32	1.38 Net	5,632	—1,920.68	Rock from fifth line above used for base.
Bitumuls Retread										
397 yds. resurface	233.45	97.50	3,387 "Bitumuls" $518.00; stone, $229.20		86.25	1,164.40	2.93	Part of $12,000 Resurfacing		
Street Oiling										
107,647 sq. yds.	1,474.99	Trucks 432.00 Roller 256.25	41,645 gals. oil, $2,228.54; 971 sand, $583		397.98	5,372.80	.0497 sq. yd.			Includes every cost.
39,942 sq. yds.	$17,945.52	$8,259.75	$23,193.17	$3,323.76	$4,474.50	$57,196.70	$1.33 Aver.	$58,118	—$1,783.40	
4½" Cement Walks										
319 yards	402.10	38.00	61 bbls. cement, $122.11	78.21	23.35	663.77	2.07	648	+ 15.77	Five separate jobs.
1,130 yards	1,801.52	43.25	239 bbls. cement, $513.08; 375 tons stone, $227.07	102.17	108.70	2,795.79	2.05 .98 curb	3,813	—1,017.21	Includes blasting, adjusting steps and lawn work.
313 yards	544.21	15.00	80 bbls. cement, $164.92; 61 yds. gravel, $36.60	85.38	25.89	872.00	1.83 .92 curb	1,145	— 273.00	Includes 196 ft. steel cornered concrete curb.
1,063 yards	1,494.59	73.25	203 bbls. cement $403.99; 178 yds. gravel, $122.13	12.22	56.54	2,162.72	1.89	2,588	— 437.50	Includes steps and extra work.
860 yards	1,891.86	38.00	198 bbls. cement, $391.77; 173 yds. gravel, $103.80	93.05	53.00	2,571.48	1.81 Net	2,192	+ 379.48	Total includes $542 tree removals.
3,685 yards	$6,134.28	$207.50	$20,085.47	$371.03	$267.48	$9,065.76	$1.93 Aver.	$10,386	—$1,332.46	

Quantities	Labor	Rollers, Trucks and Compressor	Principal Materials	Other Materials	Overhead and Engineering	Total Cost	Unit Cost	Budget Estimate	Departure from Estimate	Remarks
C. I. Water Mains										
446 ft. of 6"	$ 261.26	$ 9.50	Pipe: $273.76; Two Hydr.. $124.20	$ 93.50	$ 60.98	$ 823.20	$1.85	$ 756	+$ 67.20	205 cu. yds. earth excavated at $0.91.
1,407 ft. of 6"	1,227.29	50.50	Pipe: $866.09; Valves, $67.92..	214.45	194.10	2,620.35	1.86	4,000	— 147.11	133 ft. 8" C. I. in tunnel under R. R., $1,232.54 extra or $9.26 per ft.
522 ft. of 6"	757.94	33.50	Pipe: $321.55; Three valves, $67.92	167.12	107.84	1,455.87	2.79	1,000	+ 455.87	98 cu. yds. unforeseen rock evcavated at $4.86.
235 ft. of 6"	179.52	1.50	Pipe: $147.84	83.83	33.02	445.71	1.90	450	— 4.29	Earth figured $1.48 per cu. yd.
528 ft. of 6"	321.26	8.00	Pipe: $325.25; Hydr. $62.10	57.70	61.95	836.26	1.58	756	+ 80.36	235 cu. yds. earth excavated at $0.96.
777 ft. of 6"	627.11	29.50	Pipe: $478.63; four valves, $90.56	99.64	106.04	1,431.48	1.84	1,466	— 34.52	Earth cost $1.58 per cu. yd.
2,630 ft. of 8"	2,516.61	87.50	Pipe: $2,462.31; 7 Hy. $434.70; 9 Va. $230.81	256.63	479.08	6,467.64	2.46	6,100	+ 367.64	Trench by machine at $.40 lin. ft.
545 ft. of 8"	365.33	14.50	Pipe: $515.52; valves, $175.38	226.70	103.79	1,401.22	2.57	Not in budget		
116 ft. of 6"	92.36	7.00	Pipe: $68.99	19.24	15.01	202.60	1.75	257	— 54.40	Earth figured $.86 cu. yd.
239 ft. of 6"	263.26	6.00	Pipe: $149.69	102.29	41.70	562.94	2.36	648	— 85.06	Earth and boulders cost $1.77 cu. yd.
343 ft. of 6"	967.85	51.00	Pipe: $197.12	87.63	104.29	1,407.89	4.10	864	+ 543.89	Includes 70 cu. yds. rock at $5.44.
112 ft. of 6"	42.71	.50	Pipe: $68.99	4.82	9.36	126.38	1.13	702	— 575.62	Found old main not recorded.
109 ft. of 6"	86.94	2.00	Pipe: 68.99; Hyd. $62.10	49.21	21.54	290.78	2.67	No appropriation		Earth excav. cost $1.20.
480 ft. of 6"	381.30	8.50	Pipe: $301.16; Hyd. $62.10	124.59	70.21	947.86	1.97	702	+ 205.86	215 cu. yds. earth excav. at $1.15.
233 ft. of 6"	231.42	7.50	Pipe: $152.77	47.78	35.16	474.63	2.04	702	— 327.37	Estimated length not required.
8,722 ft.	$8,322.16	$317.00	$7 776.45	$1,635.13	$1,444.07	$19,494.81	$2.19 Aver.	$18,403	+$492.45	
Vitrified Sewer										
196 ft. of 6"	$ 183.18	3.00	Pipe: $24.42	42.41	21.04	284.05	1.45	540	— 265.95	123 cu. yds. excav. cost $.88.
168 ft. of 6"	390.51	45.00	Pipe: $22.86	80.22	43.09	581.68	3.46	972	— 390.32	20 cu. yds. rock cost $6.01.
1,000 ft. of 8" and 6"	1,753.11	84.00	Pipe: $151.91; Jute: $32.40	157.50	174.31	2,353.23	2.35	2,000	+ 353.23	578 yds. earth at $1.60; 15 yds. rock at $6.88.
800 ft. of 8"	2,059.20	189.50	Pipe: $143.19; Asphalt, $103.60	250.67	219.69	2,965.85	3.71	2,816	+ 149.85	300 cu. yds. rock at $2.13.
208 ft. of 6"	315.88	17.50	Pipe: $41.32	74.16	35.91	484.77	2.33	518	— 33.23	Includes Street Patching, 53 yds. at $1.17.
550 ft. of 6"	1,163.69	27.00	Pipe: $82.24	133.86	112.54	1,519.33	2.76	1,500	+ 19.33	302 yds. earth at $2.46; 8 yds. rock at $6.96 included.
268 ft. of 6"	768.75	68.00	Pipe: $36.49; Dynamite, $32.60	44.08	76.79	1,026.71	3.87	972	+ 64.71	78 yds. rock excavated at $5.12.
212 ft. of 6" and 8"	1,129.08	46.00	Sand: $24.00; Brick: $32.00	112.14	107.46	1,450.68	6.84	1,014	+ 436.68	130 cu. yds. rock Cost, $4 81 per yard.
185 ft. of 6"	202.35	4.00	Pipe: $25.56	50.90	22.62	305.43	1.65	333	— 27.57	Earth excavation at $1.89 a yard.
500 ft. of 6"	516.37	12.00	Pipe: $65.60; Brick, $32.00	108.62	58.72	793.31	1.59	1,296	— 502.64	285 yds. earth excavation at $1.13.
714 ft. of 6" and 8"	1,340.34	22.50	Pipe: $171.27	154.61	135.10	1.823.82	2.55	1,785	+ 38.82	Pipe labor ran 20c a foot.
188 ft. of 8"	355.16	3.50	Pipe: $38.70	57.96	36.43	491.75	2.61	486	+ 5.75	
209 ft. of 6"	798.05	47.50	Pipe: $21.87; Explosives, $17.92	41.90	95.78	1,023.02	5.12	Not in budget		65 yds. earth at $2.81; 70 yds. rock at $7.16.
223 ft. of 6"	688.65	60.00	Pipe: $29.39; Explosive, $59.13	92.29	74.36	1,003.82	4.50	648	+ 355.82	100 cu. yds. rock at $6.18.
126 ft. of 8"	302.56	14.00	Pipe: $24.73	50.38	31.33	423.00	3.36	432	— 9.00	Rock cost $10.53; Earth cost $2.01.
1,090 ft. of 8"	1,384.12	53.50	Pipe: $24.29; Brick, $45.40	302.71	141.92	1,951.94	1.76	3,348	—1432.06	
655 ft. of 8"	616.80	29.50	Pipe: $129.00	125.88	72.09	973.27	1.49	1,674	— 700.73	320 yds. trench excavation at $1.08.
191 ft. of 6"	591.99	61.00	Pipe: $28.84	71.28	60.25	813.36	4.26	832	— 18.64	45 yds. rock excavated at $7.36.
149 ft. of 8"	313.48	11.50	Pipe: $33 75	52.26	32.88	443.87	2.98	540	— 96.13	300 yds. total excavated at $.80.
7,623 ft.	$14,873.27	$799.00	$1,474.48	2,003.83	$1,552.31	$20 70? 89	$3.08 Aver.	$21,706	—$2052.08	
Vitrified Drains										
312 ft. 15"	530 50	29.25	Pipe: $205.02; dynamite, $14.98	72.52	68.18	920.45	2.95	1,145	— 224.55	34 yds. rock at $5.19. 95 yds. earth at $2.52.
786 ft. 20"	2,115.73	90.50	Pipe: $1,065.34; cement and jute ea. cost $27.20	71.31	271.86	3.670.14	4.67	4 000	— 329.86	10 yds. rock at $8.14. 410 yds. earth at $2.82.
228 ft. of 12"	364.65	10.00	Pipe: $124.34; 5 castings, $65 50	90.28	52.38	707.15	3.10	800	— 92.85	Includes 110 ft. of 10" laterals.
233 ft. of 8" and 10"	415.10	41.00	Pipe: $58.18	13.17	42.20	569 65	2 44	Not in budget		
525 ft. of 18" and 166 ft. of 8"	834.40	33.00	Pipe: $553.25; 5M brick, $100	148.34	134.32	1,813.31	3.44	2,000	— 186.69	338 yds. earth at $1.36.
215 ft. of 10"	343.45	12.50	Pipe: $69.96; brick, $65.00	73 96	45.19	610.06	2.84	No appropriation		Includes 2 basins and 1 manhole.
258 ft. of 15"	608.43	45.00	Pipe: $184.20; brick, $87.00	126.15	84.06	1.134 84	4.40	866	+ 268.84	Includes a 20 foot drop manhole and 2 basins.
267 ft. of 12"	439.70	28.00	Pipe: $100.93; brick, $42.00	84 51	55.61	750.75	2.89	940	— 189.25	147 yds. excav. at $1.68.
335 ft. of 24"	417.15	57.00	Pipe: $540.88; 8 bbls. cement $18.47	144.23	94.26	1.272 49	3.80	1,728	— 455.51	
495 ft. of 15"	830.90	149.50	Pipe: $326.20; castings, $41.98	61.05	112.77	1.522.40	3.08	1,512	+ 10.40	
616 ft. of 15", 18", 20"	711.32	56.00	Pipe: $662.73; castings, $46.00	70.64	123.74	1,670.43	2.71	2.916	+ 539.82	75 yds. earth at $1.45; 60 yds. rock at $10.60.
420 ft. of 20"	939.46	73.50	Pipe: $454.26; explosives, $34.16	131.76	152.25	1,785.39	4.25			
4 856 ft.	$8,550.79	$625.25	$4 888 58	$1 087.92	$1.236.82	$16 427.06	$3.38 Aver.	$15,907	—$659.65	

Sewage Sludge Studies in Illinois

Laboratory studies of sludge digestion have been made by the state water survey division of Illinois and a report thereon has recently been made by A. M. Buswell, chief of the division. The work extended over a period of more than five years and resulted in the development of an accelerated process for the stabilization of waste matter.

The report gives details of the studies, interesting to the student of the chemistry and biology of sewage treatment. Concerning the degradation of carbonaceous matter, the report gives the following summary:

"a. A rough separation of the carbonaceous constituents of sewage sludge and fermentation tests of these and related compounds have shown grease (soaps and fats) to be an important producer of methane.

"b. Sewage grease, in this locality, has been shown to consist of about equal parts of lime soaps and triglycerides.

"c. Digestion of grease has been shown to occur in actively digesting sewage solids and in certain types of carbohydrate and protein cultures. The digestion products are lower fatty acids.

"d. Digestion studies on lower fatty acids have proved them to be important precursors of methane, whether they arise in protein, fat or carbohydrate degradation.

"e. A brief review of the biological oxidation theories is given.

"f. The methane degradation of fatty acids is shown to be an oxidation caused by water, and a definite relation has been established between the length of the carbon chain and the number of water molecules utilized in its decomposition."

The general conclusions from the investigation were:

"1. The anaerobic degradation of some of the dominant constituents of sewage sludge has been studied with reference to the fate of these substances in the sludge digestion process in sewage treatment.

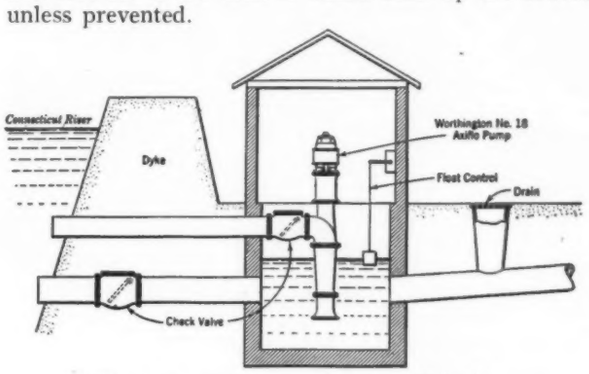
"2. The major nitrogenous constituents were shown to be urea, nucleoproteins and simple proteins, and their degradation products. The hydrolysis of urea to ammonium carbonate was rapid and complete. Insoluble proteins were hydrolyzed and peptised slowly in acid sludges (pH 5.0) but rapidly above pH 6.4. Fatty acids, ammonia and free amino acids were the normal products, but amines also were produced in acid sludges. Fatty acids were decomposed with the production of methane and carbon dioxide. Amino acids were in part re-synthesized into bacterial protein. The purine fraction of the nucleoproteins suffered almost complete destruction. During the remobilization in forms of nitrogen, not more than five per cent of that present escaped as gaseous nitrogen. Ammonia, living bacteria and amino acids were the main nitrogenous end-products.

"3. Besides proteins, the sewage solids were shown to contain grease (soaps and fats), crude plant fiber and humus-like bodies. Grease degradation was demonstrated, and lower fatty acids, methane and carbon dioxide established as end-products; thus grease was proved to be an important source of methane in digestion tank gases. The degradation of lower fatty acids was studied to establish the biochemical mechanism involved.

"4. For the degradation of lower fatty acids (and by inference for higher ones) an anaerobic oxidative mechanism has been demonstrated in which water acts as the oxidizing agent. Methane and carbon dioxide were produced in nearly theoretical yields. This mechanism probably has the wide application in anaerobic processes that the beta-oxidation mechanism has in aerobic metabolism."

Pumping Sewage During Floods at Holyoke

Holyoke, Mass., discharges its sewage into the Connecticut river above a dam. The head of water above the dam ranges from almost zero in dry seasons to eleven or twelve feet during severe floods, and dykes have been constructed to protect the low-lying land along the banks. When flood water reaches about five feet above the dam it would back up the sewers unless prevented.



Sketch of pumping equipment at Holyoke.

To meet this condition the city has set a check valve in each outlet and provided pumps to handle the sewage, discharging it into the river against a head of several feet. At each such outlet two No. 18 "Axiflo" drainage pumps are installed, each having a capacity of 7,200 gallons per minute against a total head of 26 feet. Each pump is started and stopped by automatic float control, the second pump being started only if the first fails to prevent the sewage from rising in the pump well. These pumps have open impellers which are not easily clogged.

Water Supplies of Two New York Villages Depleted

Serious water shortages are still occurring in various parts of New York State as a result of the continued drought.

The regular water supply of the village of Clayville, Oneida county, recently became entirely depelted, making it necessary to pump into the distribution reservoir, water from a pond which ordinarily is used only for fire protection purposes for a mill in the village. The water was chlorinated, but as an additional precaution, consumers were notified to boil the water. The springs which furnish the water supply of the village of Windham, Greene county, also failed recently. The emergency was met by pumping water from a nearby creek flowing through a populated watershed. Consumers were notified to boil the water pending the installation of an emergency apparatus by the Division of Sanitation for the disinfection of the supply with chloride of lime.

These instances again emphasize the responsibility of waterworks officials in charge of supplies subject to depletion to conserve water in every way possible and to take steps at once to acquire additional supplies of safe quality.—*New York Health News.*

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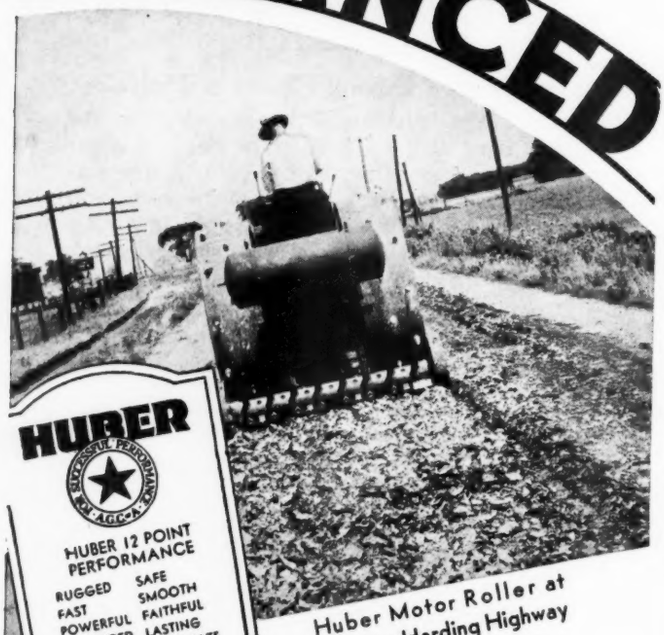

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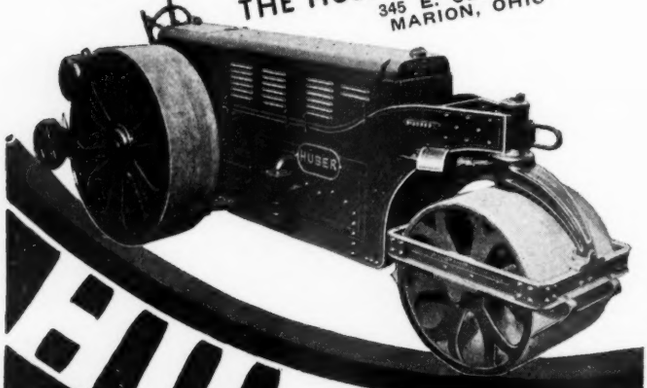


HUBER MOTOR ROLLERS

Low-Cost Bridges Lower Road Costs

For complete economy, low-cost roads should be low-cost throughout. Progressive bridge construction. Obsolescence

By C. N. Conner

American Road Builders' Association

The term "cost" as applied to highways may be defined as the cost per mile for owning and operating the highway, plus the cost of owning and operating vehicles over it. An acceptable low-cost surface may be defined arbitrarily as one costing less than $10,000 per mile for an 18-foot surface width, and which may be traveled with safety and comfort at a speed of 45 miles an hour. Low-cost bridges may be defined tentatively as those costing at first, for a 20-foot roadway, less than $100 per lineal foot for long spans and less than $50 per foot for short spans.

For complete economy, low-cost roads should be of low cost throughout, and the question of economizing on bridges and culverts offers a wide field for real savings in first cost and in net cost over a period of years. Low-cost roads should have low-cost bridges unless traffic is expected to reach the volume which exists on primary or trunk highway systems. Even then a progressive type of bridge construction may be advisable if funds are limited.

The type of structure and salvage value are important. For example, through girders and trusses are not generally adaptable to widening, while deck structures are. Steel superstructures may be salvaged and used at new locations. When necessary, old steel structures are susceptible to repairs by welding. Timber substructures of treated piling are low in first cost, have long life, and if abandoned cause small loss of investment.

During the past ten years highway traffic has increased enormously and structures must be widened, rebuilt or abandoned to ease up on approach curves or lengthen vertical curves. Traffic may reasonably be expected to increase during the next several decades. Under these conditions it seems advisable to design substantial structures that can be altered for future traffic requirements with minimum expense. Extra expense for aesthetic appearance cannot be justified on development roads, especially when substructures are not visible to the motorist.

Obsolescence is always more costly than maintenance, and an attempt to provide very far in the future for traffic changes, and to build expensive structures when low-cost structures will suffice, may be a grave risk of highway funds.

Those types possessing salvage value include steel and creosoted timber construction, with floors either of wood or of concrete, preferably the latter, as this type has proven very satisfactory and economical in several states. Rigid frame design and construction for concrete, one of the latest developments in structural engineering, is used by some designers in order to take advantage of every economy in design. The continuous beam type, using 36-inch I-beams, is becoming more popular, and in some cases 10% may be saved by designing for continuity instead of simple spans.

The above information is abstracted from a paper presented by Mr. Conner at the annual highway engineering conference of the University of Michigan.

RECENT LEGAL DECISIONS

By John Simpson

SUBCONTRACTORS

Lien for Work Not Affected by Subcontractor's Insolvency

A laborer or materialman for a subcontractor under a municipal contract for the erection of a public school is entitled to his lien against the fund in the hands of the municipality due or to grow due to the general contractor notwithstanding the subcontractor's insolvency and receivership before filing of the notice of lien. American Hardward Corp. v. Board of Education of Newark, New Jersey Court of Chancery, 148 Atl. 205.

Subcontractor's Damages on Prevention of Completion of Work

When a contract is breached by the prevention by one party of performance by the other, the recoverable loss includes what the latter has already expended in the service contracted for, and the profits he would earn if the interruption had not occurred. In an action by a subcontractor against a contractor for damages when prevented by the contractor from completing a sewer, the Maryland Court of Appeals holds, Angelozzi v. Nelson, 144 Atl. 705, that an instruction that, if the jury determined upon a verdict for the subcontractor, they should award him expenses incurred in preparation for and conduct of the work, the reasonable value of materials furnished, the profit, if any, he would have made if he had completed the contract less such sums other than payroll as the jury might find the defendant paid the plaintiff on account of the whole job, was proper. It appeared that plaintiff would have realized a profit, and the amounts to be credited the defendant were itemized in the evidence, so that the amount of plaintiff's permissible recovery was susceptible of calculation.

Payment for Subcontract Excavation Work Taken Over From Subcontractor

Contractors for the erection of a school building sublet the excavating and back filling work to a subcontractor, who, in turn, sublet it to another subcontractor. By the terms of the first subcontract the work was to be done within a certain time, under a penalty. It was understood that the second subcontractors promised to complete the work within about eighteen days. This was not done and the first subcontractor took over the work, claiming the second subcontractor had abandoned it. The second subcontractor sued the first subcontractor, claiming that the latter wrongfully refused to allow the plaintiff to finish the work, and asking for the balance due for the work done plus the expected profit on the remainder of the work. The defendant, alleging plaintiff's abandonment of the work, counterclaimed for the cost to them of its completion. Plaintiff sought $1,489 for balance of work performed, plus $210 for breach of contract, $1,690 in all. Defendant counterclaimed for $2,450.94, denying anything was due to plaintiff. Plaintiff had verdict and judgment in the trial court for $579.50. Defendant appealed.

The Kentucky Court of Appeals held, Carl Const. Co. v. Miller, 29 S. W. (2nd) 545, that, taking the evidence as a whole, it was reasonably certain that the cost of completing the work which defendant was compelled to pay was more than plaintiff even claimed was due him, and, if so, the verdict of the jury was against the weight of the evidence. Plaintiff was entitled to be paid the amount according to the contract price which the excavating actually done by him amounted to. If he unreasonably delayed the work, or did not pursue it with reasonable diligence, it was held a question for the jury whether defendant was entitled to recover on its counterclaim the difference between the contract price for doing the work and the amount which it actually paid in doing the work as ordinarily prudent men would have done it after they took it over. If the plaintiff had diligently pursued the work in accordance with the terms of the contract, and the jury should so find, he was entitled to recover any sum which he had not been paid based on the contract price. If he had not, defendant was entitled to recover on its counterclaim any sum it had expended above the contract price if it was reasonably and judiciously expended and was necessary in carrying on the work as a reasonably prudent man would have carried it on under all the circumstances, subject to a credit, if any, of any sum that plaintiff was entitled to by reason of the work actually done and not paid for. Judgment for the plaintiff was reversed and the cause remanded.

Rights of Parties on Cancellation of Subcontract

Where a contract between the contractor for the construction of a public building and a subcontractor for the stonework provided that, if such subcontract should be cancelled, any unpaid balance of the amount advanced by the principal contractor to the subcontractor should then be immediately payable to the principal contractor, the Texas Court of Civil Appeals held, American Const. Co. v. Lassig, 20 S. W. (2d) 797, that the principal contractor was entitled to interest on the balance of the advancement from the date of cancellation of the contract. If the principal contractor wrongfully breached the contract, the subcontractor's damages were held to be the profit he would have made on the unfinished stonework. The stone already delivered having been paid for, the proportionate value thereof to all the stone called for by the contract should be determined, and this amount deducted from the amount of the contract. The subcontractor's measure of recovery would be the difference between that sum and the cost of delivering the balance of the stone.

Contract for Stone According to Specifications

Where a subcontractor furnished stone under a subcontract calling for stone according to specifications attached to and made part of the original building contract, the Louisiana Supreme Court holds, Biedenharn v. Waters, 169 La. 1006, 126 So. 508, that the subcontractor cannot escape responsibility for a failure to comply strictly with his subcontract by showing that he furnished stone of the average lay of cast stone used by two other contractors.

Engineer's Final Estimate Held Basis of Price of Excavation Work

In an action by a subcontractor against a road contractor for the amount claimed to be due for excavation work, grubbing and clearing, the Arkansas Su-

preme Court held, Newkirk v. Shirley, 21 S. W. (2d) 174, that testimony should have been admitted in support of the defendant's theory that the plaintiff's work was to be paid for according to the final estimate made by the Arkansas highway commisssion's engineer, instead of the resident engineer's preliminary estimate, as the plaintiff contended. Refusal to give defendant's requested instruction that if the jury found that the plaintiff was to be paid according to the commission's engineer, and that the resident engineer furnished correct data to the district engineer, who made and sent an estimate to the chief engineer, the estimate so made should govern, was held error.

Financing Subcontractor by Contractor Does Not Release Surety

The contractor for the construction of three bridges on a state road sublet the contract at unit prices, the work to be done under the plans and specifications furnished by the highway commission and to be completed by the date fixed by the original contract. The subcontractors gave the principal contractor a bond to secure the faithful performance of the work. Subsequently, the subcontractors apparently finding that they needed help to enable them to complete the work within the stipulated time, the principal contractor entered into a written agreement to assist them by furnishing them money. It was held, Highway Iron Products Co. v. Phillips, 169 N. E. 878, that this agreement to finance the subcontractors' operations in no way changed the original contract and did not release to sureties on the subcontractors' bond.

MUNICIPAL BONDS AND ASSESSMENTS

Municipal Bond Issue for Airport Authorized

The Oklahoma Supreme Court, Schmoldt v. City of Oklahoma City, 291 Pac. 119, holds that a public park is a "public utility" within the meaning of Okla. Const. art 10, §27, authorizing a bond issue to pay for the purchase or construction of a public utility by a municipality; and that the devotion of a reasonable portion of a public park to an airport for recreation and other attendant purposes comes within the proper and legitimate uses for which public parks are created.

Lester, V. C. J. and Clark, J., dissented, the former stating, in a dissenting opinion, that in case of creating indebtedness for the purpose of purchasing or the construction of public utilities there is no debt limit, that he considered it was the intention of the framers of the State Constitution that bond issues without limit could not be authorized for the erection, purchase, or repair of public utilities unless such utilities were for the safety, comfort and convenience of the people generally of the city or town proposing their issuance, and that he did not think that an airport is a public utility, within the contemplation of the section of the Constitution.

Drainage Ditches in Connection With Street Improvements

The Alabama Supreme Court, Tarrant City v. Pope, 130 So. 390, holds that special assessment proceedings, affording due process of law, are conclusive of the increased value of the property benefited, precluding a subsequent action by the property owner for consequential damages from the construction of a drainage ditch and depreciation of the property by cutting off access thereto and causing overflows. Providing drainage is essentially a part of a street improvement consisting of surfacing of the street and installing sidewalks, curbs and gutters, and is properly included in the plans and specifications.

Sale of Improvement Bonds to Contractor

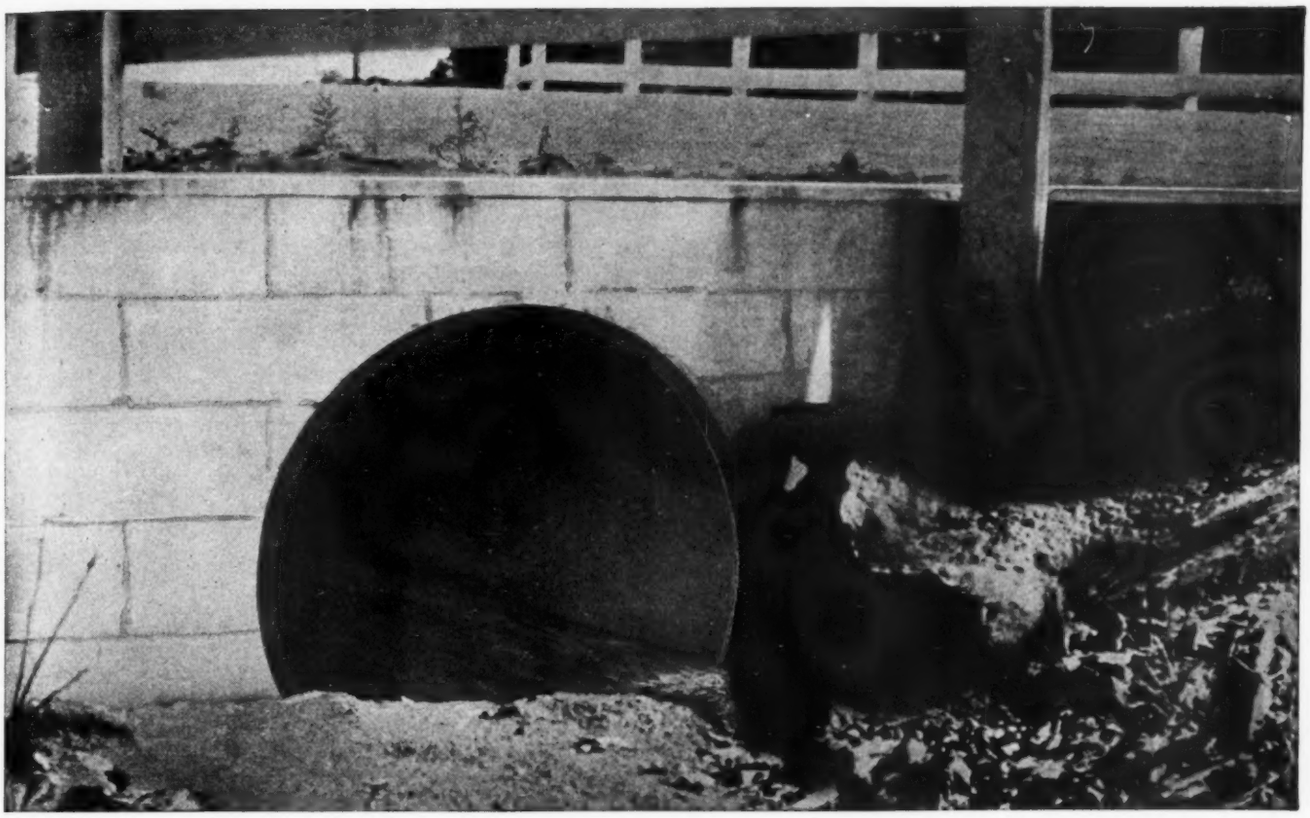
Where a statute provided that bonds of a city for street improvements should not be sold or delivered to a contractor in payment at less than par, and a contractor offered to construct sidewalks at $1.25 per square yard for cash and $1.65 if paid in bonds, a contract based on this offer, to do the work for $1.65, take bonds in payment, and certain banks to pay the contractor $76.546 for each $100 of the par value of the bonds was to this extent illegal as in violation of the statute. Bower v. City of Bainbridge, Georgia Supreme Court, 148 S. E. 517.

"Area Plan" and "Benefit Plan" of Assessment

An "area plan" of assessment for an improvement means that each piece or lot of real estate in the district is to be assessed in proportion as the area thereof is to the total area of the proposed district, exclusive of its streets and alleys. A "benefit plan" of assessment is an assessment on any particular lot or parcel of land within the district in a sum not in excess of the benefit thereto, or the enhanced value thereof, by reason of the improvement. City and County of Denver v. Denver Land Co., Colorado Supreme Court, 274 Pac. 743. In this case it appeared the city proposed to create a storm sewer district within its boundaries and assess the cost of construction according to the "area plan." By arrangement of the parties, property owners brought this suit against the city for a declaratory judgment determining whether a contemplated ordinance would, if enacted, be valid. The court holds that such an action could not be maintained, until final action had been taken by the city authorities, even if it could then be entertained. Property owners, not parties to the action, who favored the area plan, would not be bound by a declaration that it was not valid.

Emergency Contracts Not Requiring Competitive Bids

The Charter of the City of Long Beach, Cal., §294, provides that contracts with the city must be made by the city manager with the lowest responsible bidder, except that the city council may authorize the city manager to enter into a contract on behalf of the city, in writing or otherwise, without advertising for bids, for labor, machinery or supplies for "actual emergency work." The California Supreme Court, Los Angeles Dredging Co. v. City of Long Beach, says that to state what constitutes an "emergency" is not an easy task, depending on the circumstances of the case. By definition, "emergency" implies a sudden or unexpected necessity requiring speedy action; and it held that oral contracts by the city manager, requiring a dredging contractor to cease dredging intermittently and to carry the dredged materials over a longer route for an additional compensation, both for public health reasons, were for emergency work not requiring competitive bidding. The contracts, however, were made by the city manager without the necessary authority. But, being with the power of the municipality to make, it was held that they could be, and were, ratified in the manner prescribed for the making of the contracts, and the ratification was binding upon the city.



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Pavement Bases and Bumpometer Tests

"In testing the contractor's work, after its completion, the state has one practice that does not appeal to me as being altogether fair. The contractor may build his concrete base perfectly within the tolerance allowed and lay his brick so that bumpometer tests show the surface to be absolutely satisfactory. Then the state comes along with a profilometer anywhere from one week to three months after the pavement is finished, to test the pavement for bumps and penalizes the contractor accordingly. The bumps shown by the profilometer may be, and most of them probably are, due to bunching of the top dressing or to accumulation of dirt."

The above is from a talk by E. C. Blosser, chief engineer of the Highway Construction Co., of Cleveland, before the road congress held in the Case School of Applied Science, Cleveland, O.

George B. Sowers, commissioner of engineering of the City of Cleveland, gave a talk on "Subgrades and Pavement Bases," at this congress in which he said:

The purpose of pavement bases is to support the wearing surface and distribute the traffic load over a sufficient area of the subgrade so that unit pressure on the subgrade does not exceed its supporting powers. This property of distributing the load may take place through the interlocking of the constituents of the base, the cohesion and adhesion of the base material, or through the deep strength of the base.

The smoother construction of all our pavements is minimizing the effect of impacts considerably. Impacts become a factor only when the pavement has reached such a state of disrepair that the surface contains holes.

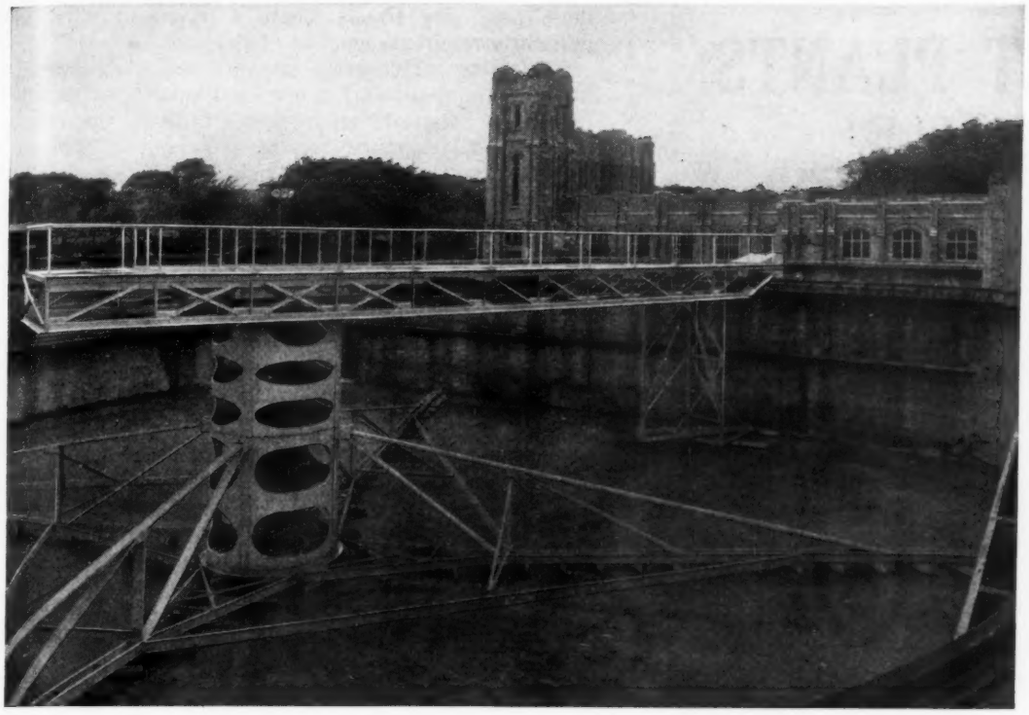
The subgrade is probably the most important factor determining the service and life of any pavement. Certain subgrade properties seem to be dependent upon the soil constituents, others depend upon the structure of the soil and still others upon the conditions under which the soil exists in the subgrade.

The condition and amount of water in the subgrade soil is one of the large, uncertain factors in the behavior of a subgrade soil. Fortunately for most city engineers, the water content in the soil under a city pavement is much easier controlled than that under a rural highway. Soils which have a high attraction for capillary water and a large change in volume due to changes in the moisture content, are very difficult to construct pavements over, unless the water in the soil can be made to remain constant.

One of the most generally met causes of subgrade trouble is not that of the natural soil, but the unstabilized condition of the subgrade due to the presence of backfilled trenches of various ages, compacting under the action of time. Every city seems to experience some of this trouble.

The treatment of the subgrade depends somewhat upon the kind of pavement base to be used. Conversely the kind and design of base for the pavement depends upon the characteristics of the subgrade.

The so-called "Black Base" or bituminous concrete pavement base is coming into quite common use and to satisfy widely different conditions. The deep freezing and heaving subgrades of northern Michigan, Wisconsin, Minnesota, require a flexible type of base, and "black base" has proven not only successful but economical. It has also found an economical use in



This photo of a Dorr Traction Clarifier, empty, shows the construction of the raking mechanism

THICKER SLUDGE—LESS PUMPING with the DORR Traction Clarifier

It costs money to pump water. Hence the lower the moisture content in any sludge, the lower will be the cost of pumping that sludge.

The ability to discharge a particularly dense sludge—in both sewage and water treatment work—is one of the notable features about the Dorr Traction Clarifier. The Clarifier is so constructed that it squeezes excess moisture out of the sludge as it sweeps the settled solids towards the central discharge cone.

In activated sludge sewage treatment plants, where a certain proportion of the sludge is pumped back to the aeration units, this feature means greatly reduced pumping costs.

In separate sludge digestion plants, a thick sludge is also desirable. Less liquid is carried into the Digester, which means that there will be less supernatant liquor returned from the Digester to the system.

Dorr Traction Clarifiers are applicable to any sewage or water treatment project where sedimentation is used. The Clarifiers operate continuously, are of simple and rugged construction, and attractive in appearance. They are in operation at many plants scattered over five continents.

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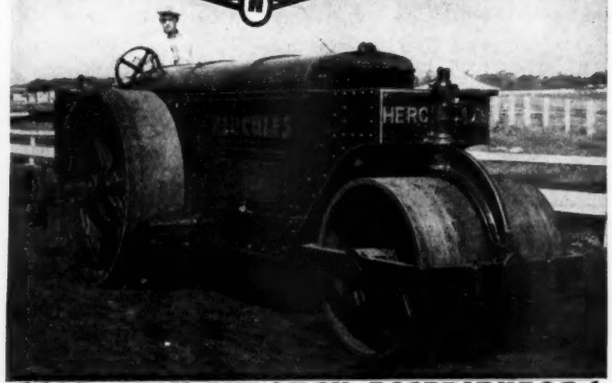

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those busy city streets where a pavement must be built in a minimum amount of time.

The factor of concrete strength required depends upon a combination of many local conditions including loads, subgrade support, subgrade friction, temperature and moisture stresses. Success has been observed in both the lean and richer types, but usually there are found local conditions which show the reasons for such base service. Where bases are placed in locations subject to low temperatures and in the presence of water, it appears advisable to use a mix of a density which will preclude the infiltration of much water into the base, to avoid disintegration of the concrete due to freezing.

Handling Unemployment in Hinton, W. Va.

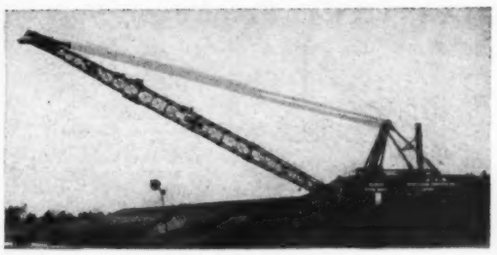
The unemployment situation is handled in Hinton, W. Va., in a way that may offer suggestions to other communities. According to the report of City Manager Hume K. Nowlan for the week ending March 7th: "A very interesting arrangement has been placed in effect through the splendid cooperation of the Community Chest. The deserving, able-bodied, unemployed men being aided by the Chest are given an order on the city for one day's work on the labor force. These men are rotated on the work schedule so as to provide employment at least one day a week. If the work rendered is satisfactory, a credit slip is certified to the Chest treasurer for $2.00 worth of living necessities. No cash is paid directly to the men, and the city and the Chest divide equally the cost of the aid rendered under this plan."

Exports of Road Machinery

Under this title we published in our March issue figures relative to the value of road machinery exported by United States manufacturers. This goes to almost all civilized countries. The illustration shows a tractor—a Cletrac model 20—owned by Vianova Contracting Co. of Vienna, Austria, hauling materials for grading the new Glocknerstrasse, a government sponsored 80-mile highway across a pass between Austria and Switzerland.

Monighan with 3-yard Page Bucket.

Bucyrus with 100-ft. Boom



New Marion Steam Dragline, 150-ft. Boom, 7-yd. Bucket.

and 3½-yard Bucket.

Equipment Used on Levee Construction

(Continued from page 25)

Loading Equipment—There is a good deal of argument as to the relative merits of elevating graders and small draglines for loading crawler wagons. Contractors generally prefer the elevating grader. The newer types with power takeoffs or extra engines for driving the elevator are efficient machines. The cost is one-third or one-fourth that of a dragline, but it is not the all-weather machine that the dragline is. As in the case of most other machinery used along the river, conditions alter cases. There is time lost in spotting the wagons for the grader and in turning the grader at the end of the pit. The dragline probably gets less pay dirt into a wagon, but loads the wagons with less lost time; it can also operate under weather conditions that will put the elevator out of operation. The diesel-powered dragline is very economical to operate.

However, either machine is highly reliable and there is probably little real difference between them so far as money producing qualities are considered. The average contractor pays his money and takes his choice. The incompetent contractors frequently neglect the former, or are unable to do it in the end.

Industrial Railways—On short haul, the industrial railway probably can seldom compete with the tractor and trailer—at present. Better methods of unloading—that is, of getting the pay dirt into the levee—must be, and are being, developed. With a little more improvement in this, the industrial railway is going to be an important factor in levee construction where a haul of more than about 500 feet is required. The methods employed in the construction of the Bonnet Carre spillway by Boone and Wester, on the levee job at Hickman, on the various jobs of the Canal Construction Co., and on the James G. Yeats Co. job on the New Madrid Floodway (to be described in an early issue) are recent and favorable developments.

The narrow-gauge dump cars and the gasoline locomotives are very satisfactory for the smaller jobs. Standard gauge equipment is coming to the front in this work, for which side dump cars of 5 or 6 to 12 yards' capacity and locomotives of about 8 or 10 tons' capacity appear to be most suitable. The investment runs to about the same percentage of the job as with tractors and crawlers. A single loading unit, with two trains, over a haul of not more than a mile, will handle from 1,200 to 2,500 yards a day. Weather conditions are of less importance with this equipment.

Draglines—On the lower river, where the borrow pit slope reduces the distance that dirt has to be moved, the dragline is an economical piece of equipment. Even on the upper river, draglines have proven of great utility. When the reach is not too great, as on small section levees, a long-boom machine may complete the entire levee section in one operation. Even where rehandling of a portion of the levee is necessary, a man who knows his draglines can do the work at a surprisingly low cost. A job last year at Hickman illustrated this well, and also brought out the usefulness of the walking type of dragline on such work. Where such a high degree of mobility is possible, even the present-day large-section levees often can be constructed by a team of a large and a small dragline, working together. On enlargement work, this is not so easily possible, since the old borrow pits interfere and necessitate a longer reach.

Handling draglines of the larger sizes is almost an art, and the contractor who can keep them going 20 hours or more a day, makes real money. There appears to be more in knowing how to handle draglines than any other equipment. A good machine skillfully operated will put out as much as 2,000 to 4,000 yards a day, depending on its size. On the Sikeston ridge levee during 1929, the Roth Construction Co. put up an average of close to 4,000 yards per day. (See PUBLC WORKS, December, 1929).

Mules are gradually passing out of the picture.

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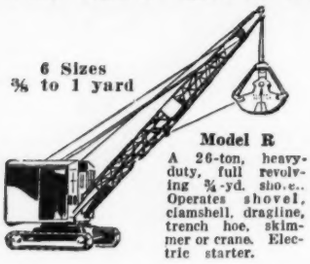

6 Sizes
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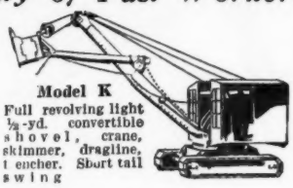
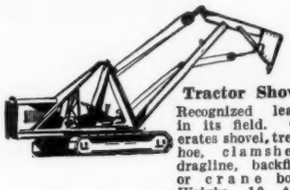
A 26-ton, heavy-duty, full revolving ¾-yd. shovel. Operates shovel, clamshell, dragline, trench hoe, skimmer or crane. Electric starter.



Model K
Full revolving light ½-yd. convertible shovel, crane, skimmer, dragline, trencher. Short tail swing



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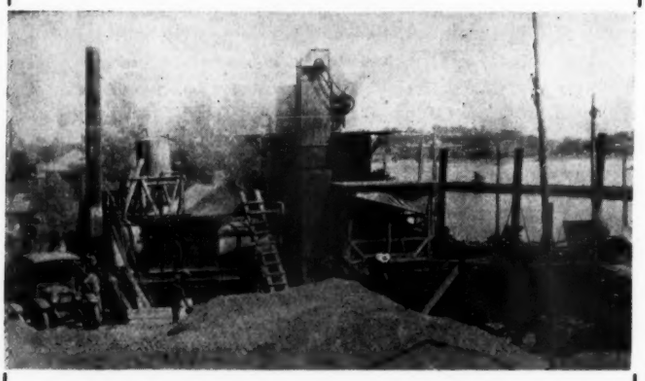

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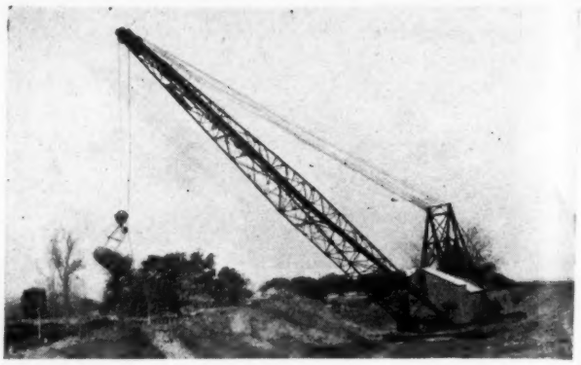

Monighan Walker, 4½ yard bucket on 150-foot boom.

During 1930, some very large draglines appeared on the river, and there appears to be a trend toward the use of such machines, though medium-size units are giving profitable and satisfactory service under a wide variety of conditions.

Tower Machines—Several of the new-type tower machines are now at work along the river; at least two of them of the electric type. These have shown up very well in dirt handling and their operation has been economical. Clarke Bros. Construction Co., operating an electric dragline on the New Madrid Floodway job, was, in January, 4 months ahead of schedule on a contract involving more than 2,000,000 cubic yards, and had placed about 75% of that amount. H. E. Culbertson Co., operating another electric tower machine below Memphis, has made excellent progress. Some of the older machines have been heightened, with satisfactory results; in other cases two older type machines have cooperated, one constructing the base section and the other obtaining the necessary height by working on the section already thrown up.

Tower machines have many advantages in reduced labor and operating costs, and in ability to work regardless of weather conditions, and doubtless will continue to maintain a place of great importance in future flood control work.

Hydraulic Dredges—These operate well under some conditions, but so far have not proven as successful as had been hoped. Forebodings in regard to the quality of the levee built by them do not seem to have been justified, and borings have indicated that such levees are satisfactory. A basic trouble in the use of dredges has been the necessity for coordinating the progress of types of equipment of differing character on one project. A limited use of this type of equipment is being continued, and indications are that progress is being made in developing methods of satisfactory levee construction by their use.

Removing Snow From Streets Increases Hazard of Mains Freezing

Snow affords considerable protection against cold, and the increasing general practice of removing it from streets makes it desirable to lay water mains deeper than formerly, especially in the northern tier of states. The Kalispell, Mont., water board reports that: "The prevailing custom in recent years of removing the snow from the streets and avenues to meet the demands of traffic, has been a serious hazard to water mains and service connections, necessitating the importance of keeping below the frost line by a safe margin."

Maintaining City Pavements

(Continued from page 22)

filling of cracks in cement concrete, but there is a distinct trend toward the use of an 85 to 100 penetration asphalt. There is usually a change in the penetration of this asphalt material, according to seasonal variations in temperature. Practically all of the cities report the patching of broken areas in cement concrete with pre-mixed bituminous concrete; however, some of them are employing a rich mixture of sheet asphalt, others rock asphalt and the various patented types of fine aggregate paving mixtures, while some few of the cities still use an asphalt seal coat. The Committee on Maintenance believes that a standardization of the patching of broken areas in cement concrete should be accomplished at as early a date as possible and is of the opinion that a spider web coat of not to exceed 1/10 of a gallon per square yard of cut-back asphalt, followed by placing a cold pre-mixed fine aggregate type of bituminous concrete, is the best method so far evolved.

The most difficult problem confronting the larger cities in the maintenance of their streets seems to be the repair of service cuts. Many of the cities have placed the repair of these cuts under contract, but the majority still appear to be doing the work with local forces.

The above is abstracted from the report of the Committee on Maintenance, Major F. M. Davison, Washington, D. C., chairman, to the Ninth Annual Asphalt Paving Conference.

Special Assessments—Some Evils and Remedies Therefor

(Continued from page 28)

A method which will take much of the "curse" out of overlapping assessment is for the legislative body to determine whether each project petitioned for is economically sound. This can be done by means of a complete engineer's report, setting forth all the significant features of the proposed improvement. Such an engineer's report should show:

1. Extent to which proposed improvement is needed.
2. A tentative assessment map upon which shall be shown the district proposed to be assessed. In many cases each parcel can be designated.
3. Assessed valuation of the proposed district.
4. Amount of unpaid assessments or bonded indebtedness. Where practical, this information should be shown for each parcel.
5. Estimated assessments for proposed improvement, based upon a preliminary estimate of the total cost of the improvement.
6. Ability of the district to pay.
7. A definite recommendation based on the above information stating whether improvement should be made at this time.

The foregoing report should enable the legislative body to see what overlaps are likely to occur, and to make desirable changes before the final plans are prepared, and the proceedings have reached the final-hearing stage.

Use of the wrong act is another abuse, which can be prevented by exercise of proper judgment by legislative body.

Excess promotion activities are due to material men, to interested public employees, and to subdividers seeking help from public funds. The cures suggested are that the legislative body should ascertain what is back of fact and face of petition; also that there be required an engineer's report, as described above, which will disclose economic and other defects.

Lien sharks take advantage of those burdened with heavy assessments. The cure suggested is a procedure by which the city would take up delinquent assessments.

Too frequently the cost of land acquisition for street opening and widening is excessive, because of inflated values which aggravate assessment burdens, and of "experts" hired by defendants to inflate appraisals. The cure would seem to be putting appraising on a scientific and professional basis.

Assessment of arterial highways against frontage often works an injustice, especially in the case of residential property. A partial remedy may be found in proper allocation to be made from public funds. However, a proper and equitable distribution of public funds is a difficult matter. The funds available for allocation in carrying out main highway improvement projects are usually limited, and, under the petition system, an undue proportion of such funds may be spent in a particular district to the detriment of the highway system as a whole. To the end that allotment of such funds may be scientifically placed, the Bureau of Engineering of Los Angeles has proposed a study and classification of all streets as follows:

1. Arterial highways, i. e., streets or boulevards which are valuable crosstown arteries, or connect state highways and more important county highways, or are valuable connectors to the central business district.
2. Secondary arterial highways.
3. Local distributary streets.
4. Local frontage streets, dedicated and improved for access for immediate frontage only.

It is likely that, eventually, a definite system for allotment will be determined, whereby excesses over certain widths of streets and thicknesses of pavements will be financed out of public funds. Such a policy will do much to equalize the distribution of this money, and to eliminate the abuses which are alleged to have made it a political football.

Among remedies proposed which are considered to be of doubtful merit are: Budgeting of public improvements. Debt limitation. Codification of existing improvement acts.

In view of the certainty that radical changes in our state improvement acts will retard development, it is imperative that all proposed new legislation be subjected to the closest scrutiny of men who are qualified by experience to evaluate the merits and demerits of such bills. Such men, obviously, are the engineers who have been obliged to perform their work under these laws, and who, consequently, have gained an intimate knowledge of their context and significance.

Heretofore, unfortunately, the engineer has not been consulted at the time legislation was drafted, and the laws which finally made their appearance on the statute books were found in many respects to be impracticable. Subsequently, the engineer was called upon to make them workable, and to iron out kinks that were not apparent to their framers.

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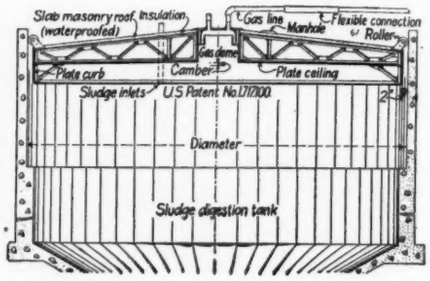

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The Schenectady Sewage Plant in 1930

(Continued from page 23)

over 52%. The quantity of monthly drawings of wet sludge varied from 1459 in September to 2315 in November, when the tanks were put in as clean condition as it is possible to get them. "The balance between grease solids applied to the tanks and ripe sludge in the tanks means nothing at times when all efforts must be exerted to provide storage space in under-capacity tanks," says Mr. Cohn.

Odor control in the tanks and of the tanks effluent as it passed through the dosing tanks and filters, was effected by means of prechlorination at rates varying from 4 to 6 p.p.m. Application of chlorine to the inlet chamber was limited to days of high humidity and light winds.

The hosing of the gas vents prior to sludge drawing was again necessary because of the tendency of the solids in the tanks to enter the gas vents and produce a tough gas-lifted scum. This hosing caused currents of semi-septic water to travel into the sedimentation compartment and resulted in high chlorine demand by the tanks. It was found that on days of no hosing, odor control was more easily effected than when water was being applied to the vents.

The recording thermometer, with the sensitive bulb immersed in the sludge compartment, indicated that the temperatures in the tank bottoms varied from a low of 48 in February to a high of 75 in August. The temperature remained consistently over 60 degrees during but five months of the year and averaged over 60 degrees during six months.

Sludge Drying Beds

As a result of an extremely dry summer, sludge drying on the open drain beds was rapid and a record amount of dry cake was removed during the summer months. The 10,565 yards of sludge, pumped onto the beds to an average depth of 10", dried to 3320 yards of 3½" cake; 3100 yards of sludge were removed to the storage field or taken directly by the farmers, while some 320 yards were still on the beds last December awaiting drying and removal. Sludge was drawn to the beds on 97 occasions, thus providing 9.7 fillings for each of the ten bed units. The average drying period was, thus, about 2½ weeks; on many occasions sludge was forkable after less than a week of drying.

The market for sludge fertilizer was even better than in previous years. It was only with difficulty that the rule preventing the removal of fresh sludge before August 1st was enforced. The farmers started drawing sludge earlier than usual and by the end of October all the fertilizer in the storage piles had been cleaned up and purchasers started removing sludge from the beds.

Temporary corduroy roads were built into an old lagoon area and the farmers gladly cleaned out this material. During the entire month of November the farmers worked on the sludge beds themselves, taking out the partly dried and frozen sludge. This saved the city much money since the services of a team were dispensed with. This is the first year since the sale of sludge was inaugurated that all stored sludge has been sold before the winter freeze-up. The price has been maintained at 25 cents a load, except for exceptionally large trucks which were paid for as double loads. The sludge has been taken by farmers for use

(Continued on page 71)

on all types of crops, has found favor with local householders for lawns and gardens, been used by the local Park Bureau and been introduced at a large golf course. Each purchaser has received the usual printed notice, cautioning against the use of sludge on crops that grow in or on the ground and go to the table uncooked.

Mr. Cohn continued to carry on an active sales campaign for sludge as fertilizer, contributing articles to the Schenectady County Farm Bureau monthly, giving addresses before a large group of market gardeners and visiting the farms of several sludge users.

Trickling Filters

It was believed that the program of bi-weekly flooding of the filters which was carried out for psychoda control from May to November caused a decrease in efficiency of the filters which was noticed during this period. On the other hand, the higher efficiency in winter might have been due to the unusually clean condition of the filters. Schenectady studies have indicated clearly that cleaner beds produce more highly oxidized effluents.

The fable of the highly gelatinized bed being most efficient has been pretty well exploded.

Fly development was rapid on the beds despite the heavy population of archorutus viaticus in the filters. That the stones inhabited by these insects are cleaner than normal cannot be denied. It is hoped that a study of the effects of hypochlorite of lime on psychoda control can be carried out during the coming summer.

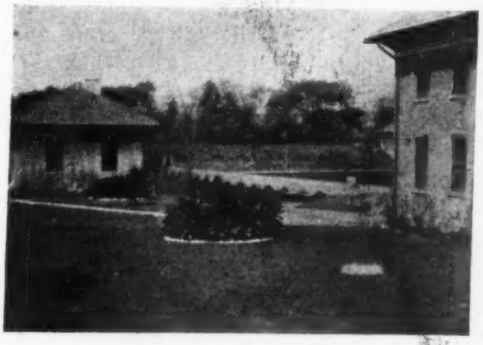
Nozzle clogging averaged 116 per day for the entire year, somewhat higher than the exceptionally low maintenance required last year. Monthly average clogging was under 100 per day during 5 months of the year. A large portion of the clogging of the summer months can be attributed to the loosening of gelatinous films from the inside barrel of the distributor laterals, this material clogging the nozzle orifices. An average of three man-hours daily has sufficed for nozzle attendances.

The physical condition of the beds was maintained satisfactorily by the picking up of the stone around the occasional pooling area, the removal of all weed growths from the beds and the repair of broken nozzles. During September each bed was given a 24-hour drying period to slough off the extremely heavy surface gelatine that had developed on the filter media during the hot weather. Examination of the filter media indicated that spalling of the stone in many places resulted in a marked decrease in size of the material. Pooling has been noted at some few points where this phenomenon is most distinct a short distance below the surface of the beds.

Averages of the analysis of the effluent made throughout the year are as follows, in parts per million: Total solids, 386; suspended solids, 64; dissolved oxygen, 47.2% saturation; B. O. D., 22; pH, 7.1.

Beautifying the Grounds

Mr. Cohn takes great interest in beautifying the grounds around the plant. Last year new flower beds were laid out, the lawns were kept neatly trimmed and large areas of flat land were kept trimmed of brush, and three thousand evergreen 3-year transplants were obtained from the State Conservation Commission and placed along the dike slopes. Flower pots were made of sections of tile and iron pipe filled with geraniums, petunias and vines. Ornamental concrete posts were built and used to construct chain fences marking the main roadways. Much broken and disintegrated concrete was patched on the tanks and filter galleries. The storage structure located along the north dike was overhauled and painted grey. Iron work, channel covers and stairs, etc., were painted, and rustic bridges were built crossing several of the tank channels. The gas vents were not painted pending the outcome of tests of several types of paint that were applied to test surfaces during the past summer. He was greatly displeased by the location of a municipal refuse dump in the canal prism just south of the plant site. Referring to this in his report, he says: "It has been extremely difficult to maintain the works site in its accustomed spotless condition. It is to be hoped that the dump will be given sanitary coverage before it is abandoned, so that neighborhood complaint will not result."



View of portion of lawns and flower beds.

The Water Wheel

(Continued from page 38)

The remainder is treated with aluminum sulfate. Mixing produces a heavy precipitate. The clarified water is then filtered. Calcium carbonate is recovered from the primary settling tanks and reburned to lime. Activated carbon has been applied prior to filtration as an experiment.

The plants at Ivry and St. Maur, which supply Paris, France[35], have not been using the **ozone** equipment which was installed before the war. The ozone plants were considered too expensive during the war and chloride of lime was then substituted. The Ivry plant is now using chlorine and sodium hypochlorite. Experiments are being conducted on rapid sand filter plants at St. Maur.

Tastes and odors associated with the nostocaceae have annoyed the citizens of Minneapolis[50], the most objectionable conditions having been caused by aphanizomenon and anabaena. Iodoform tastes also have been noticed. In addition to odor production, aphanizomenon has materially shortened the filter runs at times. Prechlorination has seemed to help reduce the numbers of algae, but ammonia-chlorine treatment was not successful.

Checking the rise of wash water or the drop of the level of the water upon **filters** has been made easier by means of an electric device[55]. Indications on a galvanometer are noted easily and timed with a stop watch. Checking of indicators and rate gauges can thus be conducted quickly and accurately. The equipment is not bulky and could easily be carried by inspectors and assistant state sanitary engineers.

The fact that water-borne **typhoid fever** has not entirely been conquered, but remains a menace, has been

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brought out forcibly by Wolman and Gorman[28]. The phenomenal drop in the death rate from 35.8 per 100,000 in 1900 to 4.9 in 1929, is a matter of gratification. The need for better control of water quality in the smaller cities is shown by the fact that 64.9% of the epidemics in the United States and 77.5% of those in Canada were in cities of less than 5000 population. About 40% of the epidemics were due to defects in purification or distribution, rather than to contamination of raw water. Unprotected cross connections, between otherwise safe public supplies and unsafe private ones, remain the most important single source of trouble. Increasing tendencies to hold cities financially liable for damages from typhoid epidemics are noted.

The **mottling of teeth** of children who are furnished with water from certain types of water supplies continues to attract attention[31]. The actual cause of the condition is not definitely known, but the failure of the cementing material between the rods of enamel allows the effect to manifest itself. Improper calcification of the rods of enamel themselves, is also indicated. In about half the young individuals the calcification is replaced by varicolored material, producing mottling. A number of water supplies studied show the carbon dioxide noticeably in excess of the amount needed to combine with calcium to form calcium bicarbonate. This has been interpreted as indicating the presence of varying amounts of sodium bicarbonate.

Ropy milk appearing in the product of a dairy was found to be due to the use of water from a surface spring[22]. In New York state a severe gastro-intestinal outbreak involving about 100 persons was found to be due to a polluted well[21]. Dysentery organisms were obtained from the feces of those sick with the disease.

Two papers from the office of the State sanitary engineer call attention to the methods used to protect **Iowa water supplies**[52, 54]. The state has 920 cities and towns, some of which are very small. Of these towns, 534 have municipal supplies, a number exceeded only in New York, Pennsylvania, and Texas. About 92% of the population of Iowa living in cities and towns is supplied with water from municipal sources.

The work of the **laboratory** of the Baltimore water department is explained by Hopkins[41], who gives instances showing the great value of the experimental and research activities of the water works laboratory. In the laboratories of the experimental filter plant of the City of Chicago, John R. Baylis[42] has continued his work on the coagulated matter passing the filters during water treatment. It has been determined that an excess of this material passing the filters is objectionable, and that the turbidity of the filtered water ought to be less than 0.1 ppm. The use of the floc detector which he developed, and of a newer centrifugal process for measuring the volume of the floc, are described by Mr. Baylis.

Who began the use of **chlorine in water** purification has been a matter of dispute occasionally. Mr. Boby, of England[38], now credits Dr. Maurice Duyk, formerly chemist for the Belgian government, with having used chloride of lime and perchloride of iron on a water at Middelkerke, Belgium, in 1902.

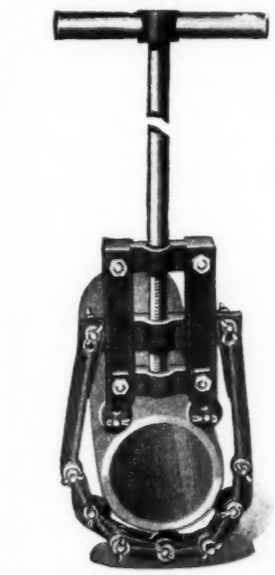
Activated carbons are receiving attention as odor removers and taste improvers. A recent publication of the Bureau of Mines[11] gives details of the production of activated carbons from many sources, but especially from coals.

The technique of **stream pollution investigations** is

(Continued on page 75)

POLLARD Pipe Line EQUIPMENT

Melting furnace for Leadite and tar



Pipe cutter, 4 to 12 inch pipe

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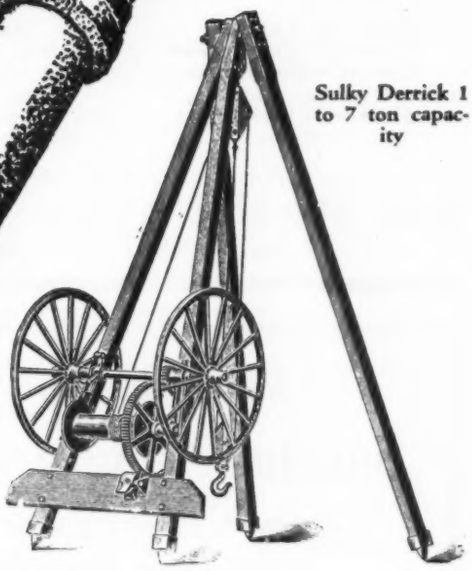

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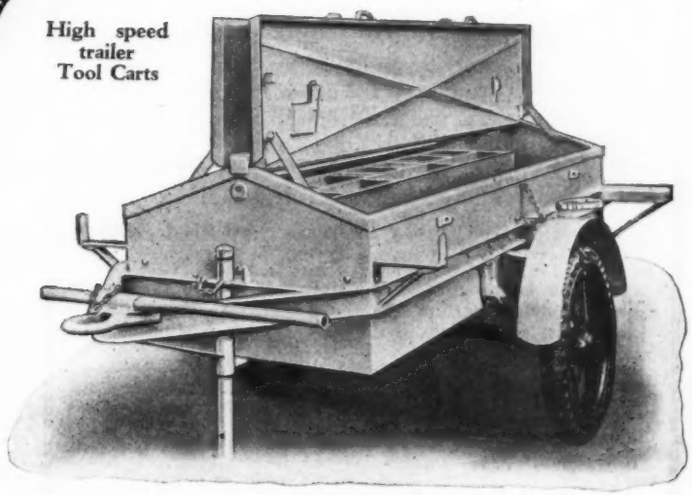

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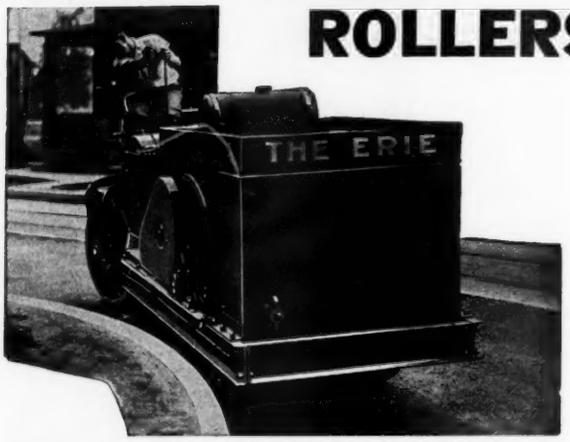

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Experiments have been carried on, at the southern outfall of the London (England) sewerage system, dealing with the treatment of sewage by means of the activated sludge process, and have resulted in the decision to construct works of a permanent character capable of dealing with ten million gallons a day, according to a statement by Lt. Col. William Butler, who served as chemist for the experiments, in a paper read on Feb. 10th before the Royal Sanitary Institute. Treatment by a variety of methods on a working scale has been carried out, plant suitable for dealing with a population of about 2,000 persons having been used. As a result of the experiments, further investigation of the Sheffield system and of the air-blowing system appeared to be the most likely to lead to good results. It finally became evident that a combination of the two methods, viz., the paddle-wheel channel plus air blowing, would be most suitable for the solution of the London problem. It had further been discovered that a two-story channel through which the sewage is propelled, as in the Sheffield system, and into which air is blown, possesses particular advantages. Diffused air is also used for the reactivation of the sludge.

The author stated that the object of treatment of this sewage is to produce an effluent which will not cause a nuisance or too greatly deplete the oxygen in the river water or otherwise be injurious to fish life; but anything beyond this is considered unnecessary. "The Surveyor," in commenting on the paper said: "From an engineering point of view the most interesting feature in the new work appears to be the double channel or storage tank. In the experimental plant a double channel was constructed in which at the end of a 60 ft. run the sewage passed beneath a false bottom, returning by a reverse flow beneath the floor of the upper channel and so circulating above and beneath the false bottom as long as desired for any required length of flow. The lower channel was of smaller sectional area than the upper channel, and the rate of flow through it was accelerated. Air was blown into the lower channel near the commencement of the return flow, and apparently diffused air entered the tank at either end, but the engineering details were not given in the paper.

"In the new and larger works requiring longer channels the same conditions are required. It is necessary to prevent the flowing columns of liquid in the upper and lower channels from commingling at the sites of interchange. In the new design the wall or false floor separating the channels is interrupted at stated intervals, and this wall separating the upper from the lower chamber is so arranged that the liquid is diverted into its proper place so that in no case is there a long period during which the sewage is not exposed to the air in the upper channel. The construction of this channel and the special design whereby the flow is thus produced cannot be described easily without a diagram. The author produced a model of the arrangement—his own design—which is of such excellence as to cause some hesitation in the acceptance of his refusal to be ranked among engineers."

The Water Wheel

(Continued from page 72)

discussed at length by workers of the Chicago Sanitary District[25]. That portion of the discussion which deals with the sampling of stream waters is especially worth while, for many persons are unfamiliar with the lack of uniformity of the composition of the water of streams, especially those which receive additions of polluting wastes.

It is suggested[26] that one of the chief functions of **plankton life** in the improvement of streams may be to keep the bacterial numbers below saturation, so that the organisms may continue to thrive and grow, at the same time consuming the organic matter of the polluting substances and bringing about a more complete and more rapid oxidation. The protozoa include numerous species which feed upon bacteria.

Changes in the numbers and variety of **minute plants** and animals of the Illinois river have been thoroughly studied by W. C. Purdy, of the United States Public Health Service[40]. He follows the stream from its highly polluted state, when only the more tolerant forms of life can persist in its waters, to points far down the channel where it approaches the character of a normal stream and the character of the organisms living in the water has likewise undergone changes of a significant nature.

The **Mississippi river** continues to supply the greatest hydraulic problem of the United States[16]. Just how this mighty stream should be controlled is far from being settled to the satisfaction of all parties.

Permission to divert 440 mgd. from the **Delaware river** tributaries has recently been recommended to be awarded to New York City (February 2) by Charles N. Burch, the Special Master appointed by the U. S. Supreme Court [19, 49]. The city had planned to divert 600 mgd. Provisions were made to prevent too low flows of the Delaware river at Port Jervis and Trenton, but no quantity in excess of 30% of the amount recommended is to be released to prevent such low flows. Costs of the action were distributed among the parties to the case—the State of New Jersey, the State of New York, the city of New York, and the State of Pennsylvania.

In southern California the need of reclaiming all types of water becomes increasingly important. Experiments in Los Angeles on the **reclamation of sewage** waters and their conversion into liquids of commercial and drinking water quality, is being studied[32].

Operation

The desirability of adequate **metering** in a small city is recognized by Madisonville, Kentucky[37]. More revenue for the water department, more justice in the charges assessed, and opportunity to save more than 100,000 gallons of water per day are claimed.

Meters need attention if they are to be kept in reasonable working condition[59]. The Kansas state law forces the consumer to pay for the meter. In Leavenworth the meters are purchased from the water department and necessary repairs are made at the cost of the service. For ease in reading the meters in the residential sections of the city, all meters are placed in outdoor anti-freeze boxes; but in the business part of the city the meters may be placed in the cellars.

Many small city water plants are **paying for improvements** from their earnings on a scale that is reasonably satisfactory, as is illustrated by a general history of the Columbia City, Indiana, water works[57], written by one who has been connected with the enterprise almost from the beginning.

Fire protection and fire protection costs are frequently in dispute, because some persons wish to impose all of the cost upon the water consumers, although many of the industries that are the greatest fire hazards have only standby connections to the city systems[33, 58]. It seems just that charges for fire protection should be borne by the taxpayers rather than the consumers. That is, the landlord should pay for the fire protection for his property, while the renter should pay for the water that he actually uses. The Wisconsin Commission assumed that the fire protection charges amounted to about 33% of the gross income of the plant, but the California Commission has estimated 7%. The idea of mutual fire insurance companies and industrial fire production seems to have started with Zachariah Allen, a mill owner of Providence, Rhode Island. After he had made improvements designed to reduce fire hazards he was angered at being refused adjusted rates[15].

Many **legal details** of the operation of water works properties are surprising. For instance, while water bills rendered by municipally owned water plants are not ordinarily considered as taxes and therefore subject to priority over ordinary indebtedness, these bills may be construed as taxes following a simple act of the state legislature[48]. It has also been established in Virginia that that portion of a city-owned water supply system serving areas outside of the community itself may be made taxable[5].

Swimming Pools

The new Chateau Laurier hotel at Ottawa, Canada, is to have a fine indoor swimming pool provided with pressure filters and other equipment for the treatment of the pool water[12]. Municipal pools of Los Angeles[4] and Cincinnati[6] gave excellent satisfaction to their patrons during the 1930 season. Water treatment has been carried out according to approved methods and consequently the quality of the water has been very high. The swimming pools and public baths of Oslo, Norway[3], are considered to be important adjuncts to the health program of the community.

The Drought

Deficiencies in the average summer rainfall were general over a large portion of the United States[17]. California with 20% and Arkansas with 35% of the normal summer rainfall were the driest states, but many other states were seriously handicapped. The country as a whole received 87% of the normal summer rainfall. In general it has been reported that typhoid has showed no significant increase, although in Missouri during the last six months of 1930 there were more than twice as many cases in the drought-stricken areas of the state as in the same areas during corresponding months of 1929[39]. Supplies in Illinois[20], Ohio[43], and New York[24] were reported seriously depleted by failure of precipitation.

Bibliography of Recent Water Works Literature

An error in numbering the articles was discovered too late to correct it. In looking up references, subtract one from Nos. 11, 12 and 13, and two from each number beyond 13.

*The Three Leading Articles.

The American City, Volume 44 (1931). No. 2, February, 1931.

1. With New Source of Water, Town Buys Its Distribution System, F. M. VanVoorhees, pp. 95-96.
2. Put "Draw Down" in Your Specifications for Wells, H. O. Williams, pp. 134-135.
3. Public Baths in Oslo for Health's Sake, page 141.
4. Los Angeles Swims in Drinking Water, C. P. L. Nichols, page 152.
5. Taxation of City Water Plant, page 175.
   No. 3, March, 1931.
6. Swimming on Cincinnati Playgrounds, R. G. Coady, page 17.
7. The Municipal Power Plant and Water Works in a Town of 3,500, Bennett B. Smith, pp. 97-98.
8. Booster Station and Cleaning Mains Solve a Suppiy Problem at Columbus, Ohio, pp. 103-104.
9. County Seat Improves Pressure in Distribution System, page 133.

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Bureau of Mines Publications.

10. A Study of the Production of Activated Carbon from Various Coals and Other Raw Materials, A. C. Fieldner, R. E. Hall, and A. E. Galloway, Technical Paper 479, 1930, 30 pages, ten cents.

Canadian Engineer, Volume 60, No. 8 (February 24, 1931).

11. Swimming Pool at Chateau Laurier, pp. 11-13.
12. Riverdale Booster Pumping Station, pp. 21, 49, and 50.

Civil Engineering, Volume 1, No. 5 (February, 1931).

13. Safeguarding Industry Against Fire, H. E. Magnusen, pp. 392-396.
14. Mississippi River, a National Flood Problem, J. F. Coleman, pp. 401-404.

Engineering News Record, Volume 106. No. 6 (February 5, 1931).

15. The Drought of 1930, F. H. Newell, page 237.

No. 7 (February 12, 1931).

16. New Formula for Friction Losses in Steel Pipe, F. C. Scobey, pp. 273-274.
17. Special Master Recommends Limited Diversion of Delaware River Water by New York City, pp. 284-286.

No. 9 (February 26, 1931).

18. Field Notes on the Water Supply of the Drought Regions, pp. 366-367.

Health News (New York State Board of Health), Volume 8. No. 8 (February 23, 1931).

19. Gastroenteritis Epidemic Traced to Well Water, page 30.

No. 9 (March 2, 1931).

20. Ropy Milk Traced to Use of Surface Spring, page 35.

No. 10 (March 9, 1931).

21. Four Communities Build New Water Filter Plants, page 39.
22. Water Supplies of Two Villages Depleted, page 40.

Industrial and Engineering Chemistry, Volume 23. No. 2 (February, 1931).

23. *Technic of Stream Pollution Investigations, F. W. Mohlman, T. L. Herrick and H. Gladys Swope, pp. 209-213.
24. Some Interrelationships of Plankton and Bacteria, C. T. Butterfield and W. C. Purdy, pp. 213-218.

Journal of the American Water Works Association, Volume 23. No. 2 (February, 1931).

25. The Grounding of Telephone Cable Sheaths to Water Pipes, Ira D. Van Giesen, pp. 149-159.
26. *The Significance of Water Borne Typhoid Fever Outbreaks, 1920-1930, Abel Wolman and Arthur E. Gorman, pp. 160-201.
27. Problems of St. Paul's Water Supply, Leonard N. Thompson, pp. 202-210.
28. Notes on Minneapolis Water Department, C. C. Wilbur, pp. 211-213.
29. Dental Deficiencies and Drinking Water, R. W. Kehr, pp. 214-229.
30. Reclamation of Treated Sewage, R. F. Goudey, pp. 230-240.
31. The Cost of Rendering Public Fire Protection Service, Edward B. Mayer, pp. 241-257.
32. Water Works Intakes and the Screening of Water, John W. Cunningham, pp. 258-266.
33. Observations on the Water Supplies of London and Paris, Edward Bartow, pp. 267-271.
34. Softening a Well Water Supply, N. T. Veatch, Jr., and B. L. Ulrich, pp. 272-275.
35. Conservation by Metering, F. R. Vannoy, pp. 276-279.
36. Early Use of Chlorine, William Boby, pp. 283-284.

Missouri Public Health News, Volume 3. No. 7 (March, 1931).

37. Typhoid Fever Follows the Drouth, R. L. Laybourn, page 147.

United States Public Health Service Publications.

38. *A Study of the Pollution and Natural Purification of the Illinois River. II. The Plankton and Related Organisms, Public Health Bulletin 198, 1930, pages xv plus 212, 45 cents.

Water Works and Sewerage, Volume 78. No. 2 (February, 1931).

39. Laboratory Research in Water Purification Plant Control, E. S. Hopkins, pp. 27-29.
40. Measuring the Volume of Coagulated Matter Passing Through Filter Beds, John R. Baylis, pp. 33-36.
41. The Drought and Water Supplies in Ohio, page 36.
42. The Design of Earthen Embankment Masonry-lined Reservoirs, Chester A. Smith, pp. 37-42.
43. Disaster Preparedness Plans for Water Works, Geo. W. Pracy, pp. 43-44.
44. Water Softening and Purification Plant of Dundee, Michigan, Carleton S. Finkbeiner, pp. 45-46.

Water Works Engineering, Volume 84. No. 3 (February 11, 1931).

45. A Water Plant to Include Carbonation, Softening and Filtration, L. R. Howson, pp. 157-158, 170-172.
46. When Water Rent Becomes a Tax, Leo T. Parker, pp. 161-162, 175-176, 179-180.
47. Special Master's Report Favorable to New York City, page 166.
48. Removing Tastes and Odors from Minneapolis Water, Frank Raab, pp. 168, 188 and 191.
49. Why Prohibit Grounding of Telephone Cable Sheaths on Water Pipe? Ira D. Van Giesen, pp. 159-160 and 180-183.
50. Insuring the Delivery of a Safe Water to the Consumer, A. H. Wieters, pp. 187-188.

No. 4 (February 25, 1931).

51. Proposed Colorado River Supply for Los Angeles Fraught with Difficulties, Frank E. Weymouth, pp. 217-218, 230, 233-234, 237.
52. How Iowa Surveys and Regulates Its Public Water Supplies, P. J. Houser, pp. 219-220, 238, 242.
53. Some Methods of Calibrating and Checking Filter Gauges, Douglas Feben, pp. 221-222, 245.
54. Mains Placed Under Tracks by Means of a Box Culvert, H. G. Brown, Jr., page 228.
55. Water Works Plant Pays for Improvements from Earnings, F. T. Schultz, pp. 246 and 249.
56. Who Should Pay for Fire Protection by Water Works, C. E. Thatcher, pp. 250 and 253.
57. Essentials in the Care and Maintenance of Meters,

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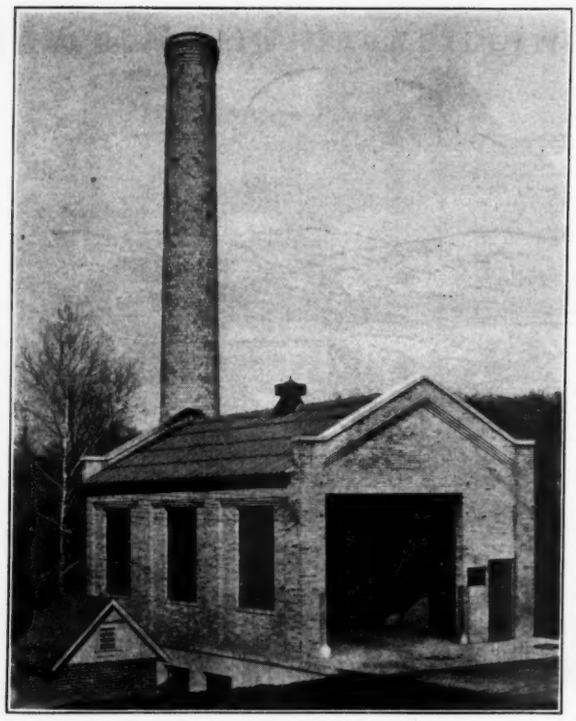

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Then D. C. Schink, commissioner of streets, conceived the idea to relieve the unemployment situation and at the same time build a storm sewer which was badly needed in the city. He and other engineers in his office estimated that the cost of constructing the storm sewer would be greater than the appropriation already made by council for sewer construction but he prevailed upon the council to pass an ordinance levying a 1-cent a gallon gasoline tax, the proceeds from which, together with the money already appropriated for sewers, would be sufficient to cover the cost of the construction of the storm sewer by the jobless men.

In course of the construction work 1400 men were given work. Only persons who had resided in Joplin for two preceding years were hired. The workers applied to the city civil service commission, presenting a statement from three business men attesting the bearer was a two-year resident in Joplin, and each man was given a number and registered.

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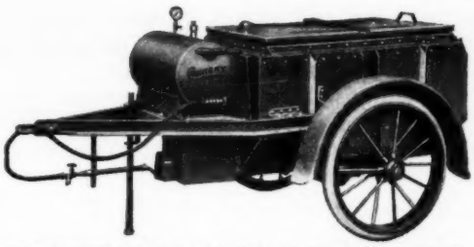
At that time 402 miles of streets were lighted by gas and one mile of Broadway by electricity. (Manhattan now has about 500 miles of streets, and Greater New York about 5,000 miles.)

Four New Water Filtration Plants in New York

Several new water filtration plants are under construction in various communities of New York State.

The city of Albany is building a plant for the treatment of the new water supply which is being developed in the foothills of the Catskill mountains. It is expected that construction will be finished about July 1 and that the water will be delivered to consumers in July or August. This will eliminate the use of the Hudson river as a source of supply. The present filtration plant and pumping station, however, will be held in reserve for emergency use.

A new filtration plant for treatment of the supply to be derived from Potuck creek has been practically completed in the village of Catskill, Greene county. As soon as the reservoir on this watershed becomes



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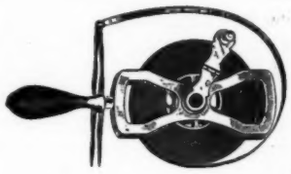

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This will all be done entirely at our own expense, guaranteeing satisfaction, and the community will be under no obligation whatever, except to collect and furnish us with the organic matter.

We shall be pleased to give detailed information to any interested community or arrange for a visit by our representative.

A. A. WHITE, INC.

Contractors and Engineers

BOX 203 LEBANON, PA.

WOOD'S *New*

ALL-PURPOSE

SANITATION UNIT

ODORLESS - DUSTLESS - WATERTIGHT

This super-rugged body easily handles all types of refuse —garbage and rubbish. Loading space on top for trees and other bulky objects. Closely lined doors and sealed seams prevent flow of dust, ashes or liquids. Low chassis mounting makes easy hand loading at sides. Sliding, self-locking side doors; easily operated top doors for snow loading. Automatically opened tailgate. Self-trimming. Ranges of sizes available. Write for literature.

WOOD HYDRAULIC HOIST & BODY CO.

DETROIT MICHIGAN

When writing, please mention PUBLIC WORKS

filled, the use of Hudson river water will be discontinued.

The new plant at Lockport, Niagara county, is also nearly finished, while at Ossining, Westchester county, facilities for water filtration are under construction.

When these installations are in operation there will be a total of 125 water filtration plants in use in the State outside of New York City.—*New York State Health News.*

Governor in Control of Fall River's Finances

On February 20, 1931, the governor of Massachusetts signed a bill vesting in the state drastic authority in the financial affairs of Fall River, a city with a population of 115,274. The bill had been introduced on behalf of local business and industrial leaders, with a view toward restoring the city's credit which had suffered because of the depression in the city's textile industry and the falling off in taxable valuations. Under the provisions of this new law, the governor will appoint a board of finance of three members whose salaries will be paid by the city. The board will supervise the financial affairs of the city, select its fiduciary officers, and control all expenditures. The governor also has authority to remove any employee of the city with the advice and consent of the executive council on request of the board. The law provides authority for the city to borrow sums not to exceed $3,500,000, payable within ten years, for retirement of certain outstanding obligations, and the board of finance will remain in power with its authority preserved from change, except by its own consent, during the period in which any of the loans remain unpaid.—*Public Management* for March.

Ready-Mixed Concrete—Some Advantages in Using It.

In a recent letter to contractors, the Superior Ready-Mixed Concrete Co. of Cincinnati, O., listed as follows some of the reasons why it is advantageous and economical to use ready-mixed concrete:

"(*a*) The exact amount of concrete is delivered to the job. You have no small amounts of sand, gravel, or cement left over. (*b*) You save the materials wasted on every job being tramped into the dirt, or cement damaged by water. (*c*) You have no uncertain labor bill for shoveling, wheeling and mixing. (*d*) You have no investment in mixers. No repairs or depreciation. (*e*) You save the cost of cement sheds and storage bins. (*f*) You save transportation and setting-up costs on mixing plant. (*g*) You gain in working space, no storage of concrete materials. (*h*) You know the cost. You know the strength. You know the mix is rigidly controlled and the water measured. Leaks and losses are eliminated. (*i*) You can increase your day's output of work to the amount of material you can handle, without depending on the capacity of your limited job mixer, for quantity. Increased production means increased profits."

According to J. D. Root, district commissioner of the Fifth District of Dickey county, N. D., that district uses an F.-W.-D. truck equipped with an underbody scraper on road maintenance work patrolling 90 miles of road, at a cost about $500 a month less than that of the equipment previously used.

ABSOLUTE UNIFORMITY

Control No. 441

This Certifies, that the MINERALEAD contained in this carton has been tested for physical properties, chemical constituents, as well as jointing efficiency.

Physical Properties OK Poured Joints OK
Chemical Analysis OK Approved by AMG

THE ATLAS MINERAL PRODUCTS COMPANY
of Pennsylvania
MERTZTOWN, PENNSYLVANIA

MINERALEAD

FOR JOINTING BELL AND SPIGOT WATER MAINS

is checked systematically to insure perfect performance

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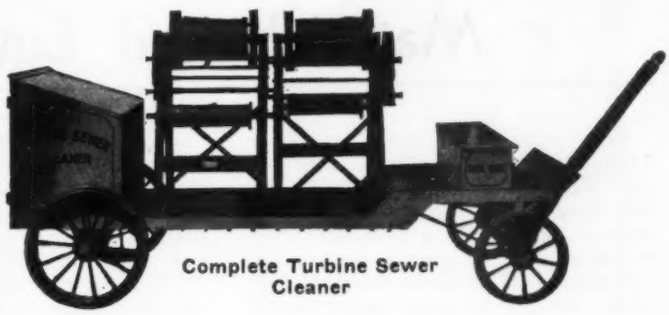

Complete Turbine Sewer Cleaner

Self Propelling Ferret Turbines, Windlasses
Adjustable Turbine Sewer Cleaners
Sewer Braces (Cable Guides)
Drag Type Sewer Cleaners
Five Types of Sewer Rods
Sewer Cables
Conduit Rods

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5210 W. State Street Milwaukee, Wisconsin

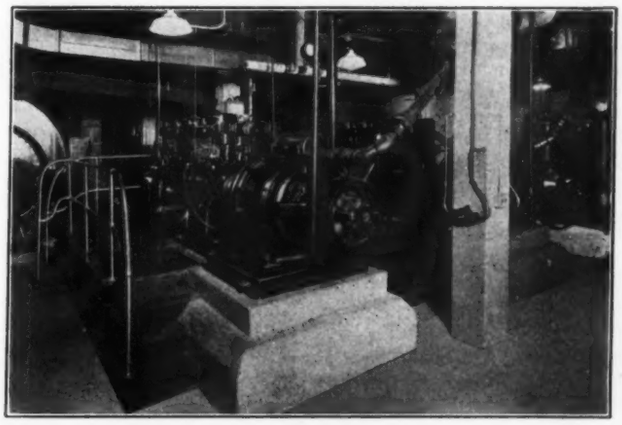
One of the Finest Installations

for standby service is the 120 K.W. twin unit (240 K.W) in the Canal Bank & Trust Co. Building at New Orleans. It is similar to the Hibernia Bank installations made 7 years ago and always dependable.

Sterling High Duty Internal Combustion Engines

Sterling — THE ENGINE OF REFINEMENT

12 to 565 B.H.P.
Gas or gasoline



Two 120 K.W., G. E. generators each direct connected to straight 8 cylinder 240 H.P. 1200 R.P.M. Sterling engine. Supplies power for lights and elevators when main current fails.

STERLING ENGINE COMPANY

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900 CHRYSLER BUILDING DEPT. C-5 NEW YORK, N. Y.

Check the *classified* INDUSTRIAL LITERATURE section, pages 91-98 for new bulletins.

Materials and Equipment Catalogs

Ready-Mixed Concrete — Stephens-Adamson Mfg. Co. of Aurora, Illinois, have just published a 10-page booklet describing their conveyors, elevators, hoppers and batching equipment for central proportioning and concrete mixing plants. The book contains diagrams of typical plant arrangements and features a new automatic photo-electric cell control for increasing the accuracy and economy of concrete mixtures.

Elevating Grader. — The Austin-Western Road Machinery Co., Chicago, Ill., has published a folder describing the new 1931 Model Austin Contractors' special elevating grader with 42-inch carrier and anti-friction bearings. From reports from the flood control area, relayed through Lou Krager, this must be a real machine.

Leaning Wheel Grader.—The Caterpillar Tractor Co., Peoria, Ill., a 32-page illustrated catalog describing their new 60 Leaning Wheel Grader. As usual with Caterpillar publications, the essential data are all there and the booklet is beautifully gotten up.

Power Drag Scrapers. — Sauerman Bros., Inc., 438 South Clinton St., Chicago, Ill., have published a 72-page, well illustrated booklet, giving de-detailed descriptions of Sauerman power drag scraper equipment, accompanied by photographs and operating data showing how this equipment is reducing costs on all classes of earth handling work. An interesting and valuable publication. Ask for Booklet 14.

The first 21 pages are devoted to a description of equipment. There are 9 pages on sand and gravel excavation; 7 pages on cut-and-fill and grading work; 3 pages on stripping overburden; 5 pages on miscellaneous excavation; 3 pages on handling ore and rock; 9 pages on tower machines, of which 3 pages are devoted to levee work; and other valuable data.

Caterpillar Graders.—The Caterpillar Tractor Co., Peoria, Ill., has published an illustrated folder on Caterpillar graders, planers and patrols.

Electric Shovel and Dragline.—Bucyrus-Erie Co., South Milwaukee, Wisc., have issued a new bulletin describing their 75-B electric shovel and dragline.

Wire Rope.—The Hazard Wire Rope Co., Wilkes-Barre, Pa., has published a new pamphlet describing "Lay-Set" preformed wire rope, which is claimed to have many advantages. This contains much data of value.

Aggregate and Gravel Plants.—The Pioneer Gravel Equipment Co., Minneapolis, Minn., has published a series of interesting and valuable folders describing their portable washing plant and their portable duplex screening, crushing and loading plant. The washing plant produces concrete aggregate, and the duplex crushing plant is a large capacity plant for crushed gravel surfacing of highways.

Use the Coupon on Page 91 if You Want Any of These.

Pyrometers.—The Brown Instrument Co., Philadelphia, Pa., have issued a valuable catalog which contains 104 pages and 141 illustrations. It presents a comprehensive resume of the theory and practice of applied pyrometry, together with descriptions and illustrations of all instruments, thermocouples, protecting tubes and other required equipment. Address PUBLIC WORKS for copies.

Modernized Hydrants.—R. D. Wood Co., Philadelphia, Pa., has published a new folder describing the Matthews Modernized Hydrant, stated to be "the most important advancement in fire hydrant design in sixty-four years."

Street Lighting—Utilitarian street lighting equipment and ornamental street lighting equipment are described in two new publications, identified as Catalogs 218-A and 218-B respectively, of the Westinghouse Electric and Manufacturing Company, Edgewater Park, Cleveland, Ohio.

The term "utilitarian" is applied to those types of street lighting equipment in which the current is carried to the lighting units by overhead wiring, to distinguish installations of this character from "ornamental" street lighting systems, in which the energy is conveyed to the lighting units through underground cable construction.

Each of these new publications includes general information regarding street lighting installations, descriptions and photographs of the various Westinghouse street lighting units and standards, and descriptions of street lighting accessories. Attractive covers, printed in four colors, are features of these catalogs.

News of Engineering Societies

New York State Sewage Works Association

The third annual meeting of the New York State Sewage Works Association was held in Albany, N. Y., March 5, 1931. Eighty members and guests were registered. At the business meeting W. P. Gyatt (Syracuse), C. A. Howell (Buffalo), and E. B. Phelps (New York) were elected to the Executive Committee in place of H. B. Cleveland, M. Cohn and G. D. Holmes whose terms of office expired. John F. Skinner of Rochester was elected president, and Professor E. B. Phelps of New York City, vice-president. A. S. Bedell, State Department of Health, Albany, was reappointed secretary-treasurer.

At the morning session Lawrence Luther gave a paper describing construction and operation of the sewerage system and sewage treatment works at Freeport, Long Island.

At the luncheon Dr. Huntington Williams, Secretary of the State Department of Health, welcomed the group on behalf of Dr. Parran, the State Commissioner of Health, and assured them of the latter's interest in the activities of the association. W. J. Orchard proposed to make use of civic pride to obtain sanitary improvements through some system of scoring health standards.

The afternoon was devoted to a symposium on sludge. E. F. O'Brien of Syracuse, N. Y., opened the discussion on "Collection and Digestion," and was followed by a prepared discussion by W. B. Corwin, Larchmont, N. Y. W. A. Ryan, Rochester, N. Y., presented a paper on "Drying and Disposal," which was followed by prepared discussion by Morris Cohn, Schnectady, N. Y., and G. E. Willcomb, Albany, N. Y. Both subjects were fully discussed from the floor.

The next meeting of the association will be held in Freeport, N. Y., on June 5-6, 1931.

Maine Highway and Bridge Contractors' Association

A majority of Maine highway and bridge contractors have formed this association, which has as its object the creation of better relations between and among contractors, and to better conditions in public contracting in the state.

E. C. Wilson is president, L. W. Smiley is vice-president, and L. W. Barton, 76 Main St., Waterville, Maine, is secretary.

NEWS OF THE DISTRIBUTORS

Wells Bros. Construction Company, Chicago, Ill., have instituted an incinerator division for municipal incinerators. This department will be in charge of Joseph Goder, who has designed many municipal incinerator plants in the United States.

The Superior Construction Equipment Company will distribute and service the complete line of 1¼-yard to ½-yard shovels, cranes, draglines, trenchers and skimmers for the Byers Machine Company, of Ravenna, Ohio. They will also handle the Byers Excavator Company line of Model 40 and 50 small shovels and cranes.

The Tractor and Equipment Co., 520 Passaic Ave., Newark, N. J., will handle the products of the Universal Power Shovel Co. in the eastern territory.

Reading Iron Company, Reading, Pa., announces the appointment of F. W. Deppe, formerly district sales representative at St. Louis, Mo., as general manager of sales with offices at 230 Park Avenue, New York, N. Y.

Kenneth G. Sites has joined the sales organization of the Hydraulic Development Corporation and will sell Hydro-Tite in New York, New Jersey and Pennsylvania.

R. K. Rothrock, 2204 Jefferson Ave., New Orleans, La., represents the Chicago Pump Co. in the New Orleans territory. J. M. MacCrea, 153 Oakland St., Syracuse, N. Y., represents the Chicago Pump Co. in the Syracuse territory.

The Canton Culvert and Silo Company of Canton, Ohio, manufacturers of corrugated metal culverts, since 1908, have recently changed their name to the Canton Culvert Company.

Several changes in the sales organization lineup for 1931 have been announced by the Barber-Greene Co., of Aurora, Illinois, manufacturers of material handling equipment. E. H. Cooper, since 1927 manager of the Barber-Greene Co. of Kansas City, has been appointed Ditcher Line Head for the Western Division to operate with J. M. Burns Ditcher Line Head for the Eastern Division. The territory formerly served by E. H. Cooper as manager of the Kansas City office of Barber-Greene Co., is now divided between the Kenney Machinery Co., of 2301 Grand Avenue, Kansas City, Mo., and the Buda Engine Service of 521 West Archer St., Tulsa, Okla. Two new branch managers are also announced. They are Frank Ness, manager of the Barber-Greene Co. of Philadelphia, and D. H. McLean, manager of the Barber-Greene Co., of Cleveland.

The Koppers Company announces that the sale and distribution of all the products of its subsidiaries, the American Tar Products Company, the Koppers Products Company, and the Tar Products Corporation, will be consolidated and unified under the name of Koppers Products Company.

Bucyrus-Erie Company of South Milwaukee, Wis., has acquired a controlling interest in the Monighan Manufacturing Corporation of Chicago, Ill. This company builds a complete line of Diesel and electric dragline excavators, all of which are mounted on the patented Monighan walking device.

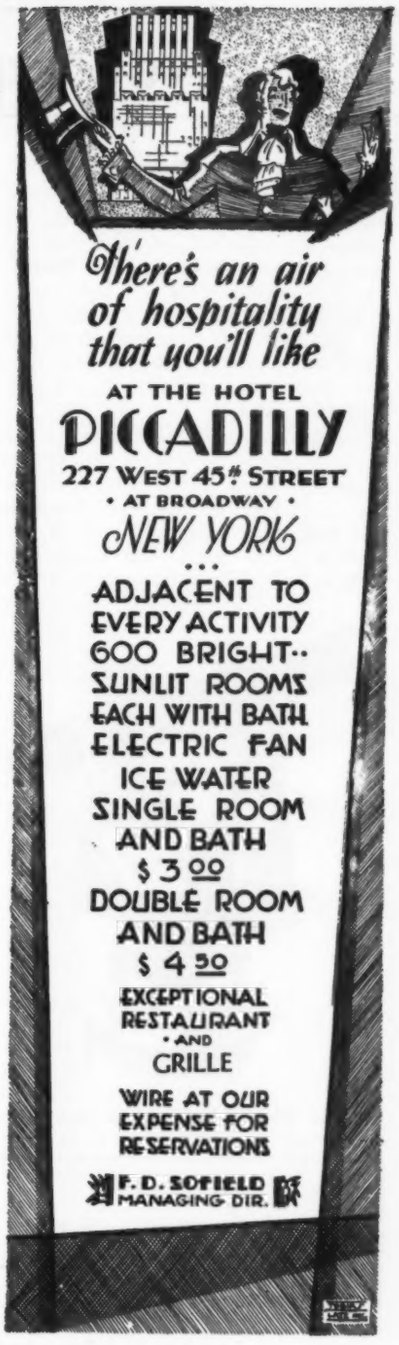
The Monighan Manufacturing Corporation will continue to operate as a separate company and the management will remain the same as in the past with O. J. Martinson continuing as president. As of March 1 the sale of the Monighan product in both this country and throughout the world will be handled exclusively by the sales organization of Bucyrus-Erie Company and its associate company Ruston-Bucyrus, Ltd., Lincoln, England. All branch offices and representatives of Bucyrus-Erie Company and Ruston-Bucyrus, Ltd., are prepared to supply complete information on Monighan machines.

On March 4th a decree of the Federal Court was issued placing the Good Roads Machinery Company in a receivership in equity. Earle S. Philips and Robert V. Bolger were appointed by the Court as co-receivers to continue to operate the business. The receivership was a friendly one and was entered into with the idea of effecting a reorganization at the earliest possible date.

Mr. Philips has been vice president and general manager of the Good Roads Machinery Company for several years and it is felt that the present action will be advantageous to all parties concerned. The company is solvent and it is hoped will be able to take care of all obligations at a very early date.

The Joseph G. Pollard Co., Brooklyn, N. Y., manufacturers of pipe line equipment for water and gas companies, have opened a branch office and warehouse at 1749 West Lake St., Chicago, Ill. W. A. Start, for several years with the Neptune Meter Co., and later with the A. P. Smith Mfg. Co., covering the central west and southwestern states will be in charge. A complete stock of pipe line equipment will be carried at the Chicago warehouse, thereby facilitating prompt shipment in the territory west of Ohio.

The new Kansas City offices of the McWane Cast Iron Pipe Company are announced as having been opened March 1st, at 1006 Grand avenue in that city, with C. H. Allen in charge. Mr. Allen has been connected for a number of years with the Chicago sales office of the company, and his promotion to managership of this, the eleventh district sales office of the McWane-Pacific States Cast Iron Pipe interests, will bring him in closer contact with Kansas, Nebraska, Missouri, and northern Oklahoma. The new office is opened on the eighth anniversary of the completion of the first unit of the original McWane pipe foundries in Birmingham, and is now a part of a pipe-making organization with large foundries in Birmingham, Alabama and Provo, Utah, and with sales offices in key cities throughout the nation.



New Equipment

New Size "Utility" Air Hoist

A larger and more powerful air hoist, known as the HU, has been added to the line of hoists manufactured by the Ingersoll-Rand Company, 11 Broadway, New York. This new hoist has a rated capacity of 2000 pounds at a rope speed of 120 feet per minute, but it will safely handle loads greater than this. The cable capacity is 550 feet of ⅜ inch cable.

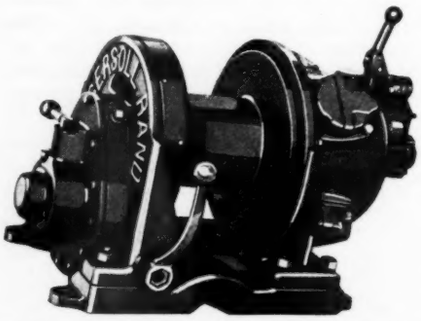
The hoist is suitable for use wherever a portable hoist of this capacity can be employed. It is used for skidding and hoisting timbers, handling tools and other material, hauling and spotting cars, single cable slushing work, etc. The hoist has a high overall efficiency and remarkably low air consumption.

The weight without cable is 490 lbs., length 32 inches, width 22 inches, and height 23 inches.

The Warren-Knight Transit-Level

A Transit-Level

The Warren-Knight Co., Philadelphia, Pa., have brought out a transit-level in response to a demand for this combination instrument. This is an instrument of entirely new design, with new optical system, and new dual bearing standards—a new and exclusive feature which enables the adjustments of the telescope and level to be checked as easily, and in the same way, as an ordinary wye level. It is an accurate, dependable, compact instrument, conveniently packed in a substantial hardwood carrying case, complete with trivet, plumb bob, reading glass, sunshade and tripod.



Ingersoll-Rand Utility Hoist for Loads Up to 2000 Pounds

15-Ton Trackson Crawler Wheels

15-Ton Trackson Crawler Wheels

The new 15-ton Trackson Crawler Wheels made by the Trackson Company, Milwaukee, Wis., embody a number of exclusive features. They are designed for mounting on various types of wagons used for heavy hauling in general construction work, logging, pipe line and other oil field work, pit and quarry operations, and other industrial fields. The outstanding features of the new Trackson Crawler Wheels, however, are their practicability and their easy pulling qualities, due to the use of large truck wheels, to the retention of the original camber or arch in the tracks, and to the use of extra-wide track shoes that provide greater bearing area on the ground. Shoes for the 15-ton wheels can be furnished in two widths, the 17-inch width for use on five- and seven-yard cart type wagons, and the 19-inch for use on heavier wagons.

Sno-Plows. A whole lot of practically valuable information about snow removal and removal equipment is contained in a new publication recently issued by Carl Frink, Clayton, 1000 Islands, New York. It's worth having against the time when there's snow to be removed.

State Highway Cost Data

Bituminous Macadam-Penetration

STATE OF RHODE ISLAND

Bids opened March 11, 1931.

Low 5 of 19 bidders on Contract No. 3108, Emergency F.A.P. No. 73-A, Westerly, Westerly Shore Road.

			a	*b*	*c*	*d*	*e*
3.10	Acres	Clearing & Grubbing	50.00	100.00	100.00	50.00	70.00
20	Each	Cutting-Removing Trees	10.00	8.00	10.00	10.00	10.00
28,600	C.Y.	Earth Excavation	0.40	0.45	0.35	0.30	0.40
32,700	C.Y.	Borrow Outside Location	0.40	0.40	0.40	0.45	0.45
2,700	C.Y.	Ledge Excavation	2.00	1.50	2.00	1.75	2.00
7,060	C.Y.	Gravel Foundation	0.60	0.60	0.90	0.75	0.70
450	L.F.	12" Sub-Drain	2.00	1.00	1.50	1.90	2.00
1,992	L.F.	12" Corru. Metal Pipe	0.50	0.50	0.60	0.50	0.60
144	L.F.	18" Corru. Metal Pipe	0.65	0.50	0.60	0.65	0.60
134	L.F.	24" Corru. Metal Pipe	0.75	1.00	0.75	0.80	1.00
5	Each	Catch Basins Type "D"	75.00	50.00	100.00	70.00	80.00
32	C.Y.	Concrete Masonry	20.00	20.00	20.00	17.00	20.00
93	C.Y.	Stone Masonry	8.00	10.00	10.00	8.00	8.00
20	S.Y.	Cobble Gutter (Grouted)	2.00	2.25	1.50	1.40	2.00
19,200	L.F.	Wooden Guard Rail "N"	0.40	0.40	0.40	0.38	0.40
11,760	Tons	Crushed Stone-Trap Rock	2.70	2.90	3.00	2.95	2.80
22,000	Tons	Crushed Stone Base	0.70	0.65	0.70	0.85	0.65
4,400	C.Y.	Filler for Base Course	0.65	1.00	1.00	0.90	1.00
169,750	Gals.	H. H. & A. Bit. Binder	0.045	0.045	0.04	0.035	0.045
151,130	S.Y.	Trimming & Fine Grading	0.02	0.01	0.01	0.015	0.01
14,000	L.F.	Rebuilding Walls	0.40	0.45	0.30	0.35	0.45
1,300	L.F.	Erecting Fence	0.20	0.20	0.15	0.20	0.20

a. R. H. Newell Co., Uxbridge, Mass. $112,613.45. *b.* H. T. Smith Exp. Co., Meriden, Conn. $114,417.05. *c.* Perini & Ampollini, Framingham, Mass. $114,967.40. *d.* Corrado & Lepore, Providence, R. I. $115,404.00. *e.* Byron G. Jordan, Providence, R. I. $116,071.65.

FREE INDUSTRIAL LITERATURE

Check up now and see if you need any of the bulletins described on these pages. They will be sent free. Just fill in the form at the bottom of the page or write to the company direct, giving number of booklet and mentioning PUBLIC WORKS

Construction Methods and Equipment

Accessories, Motor Truck

1. Truck accessories—winches, power take-offs, derricks, special bodies, earth boring machines, and trailers of all capacities are described in a series of folders issued by the Four Wheel Drive Auto Company, Clintonville, Wisconsin.

Asphalt Heaters

8. A 54-page booklet issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describes and illutsrates oil, wood and coal burning asphalt and tar kettles, tool heaters, sand dryers, tool boxes, traffic line markers, grout mixers, asphalt tools and their use in road construction.

9. "Hotstuf," the master oil burning heater, is the only heater with patented elevated melting chamber for Asphalt, Tar and all bitumens used in road and street construction and maintenance, roofing, water proofing, pipe coating, etc. Described in illustrated manual No. 11—Mohawk Asphalt Heater Co., 94 Weaver St., Schnectady, N. Y.

Asphalt Plants

10. J. D. Farasey Mfg. Company, Cleveland, Ohio, issue a booklet for use and specifications for Farasey Portable Asphalt Paving Plants. These R. R. 1-car plants have easy capacity of 2,250 yards, 2" surface per 8 hours. Cheap to operate.

Asphalt Rollers

12. A 16-page booklet printed in two colors gives full details and specifications of the Erie Roller. Also explains how to use it to save tamping costs. Numerous action pictures. Issued by the Erie Machine Shops, Erie, Pa.

Chip Spreaders

25. The Universal Road Machinery, Company of Kingston, N. Y., have issued a booklet describing their Reliance Chip Spreader, a special trailer, operating in the reverse direction, designed for resurfacing bituminous highways. Spreads to a width of 8' to any desired thickness.

Concrete Accelerators

30. "How to Cure Concrete," a forty-seven page manual published by the Dow Chemical Company, Midland, Michigan, treats fully the subjects suggested by its title. A well-illustrated and instructive volume.

31. "Curing Concrete Roads with Solvay Calcium Chloride," 30 page booklet. Comprehensive. Contains tables, illustrations, suggestions for testing devices. Covers the subject in considerable detail. Published by the Solvay Sales Corp., 61 Broadway, New York, N. Y.

35. "A report on Current Practice of using Calcium Chloride for curing Concrete Pavements, Building Construction, Bridges, Culverts and Concrete Products." Concise practical data, embodies latest information on subject. Issued by Columbia Products Co., Barberton, Ohio.

Concrete Mixer

44. Jaeger Concrete Mixers, both Tilting and Non-Tilting types, from 3½s to 84s size, with illustrated descriptions of all types mounting, power and loading equipment—64 pages published by The Jaeger Machine Company, Columbus, Ohio.

Crushers

56. Pioneer Gravel Equipment Manufacturing Company, Minneapolis, Minnesota, publishes complete 80-page manual, showing blue print sketches of set-ups in pit or quarry of the eleven different sizes of Pioneer Crushing Plants.

57. Up-to-date information on Stone Crushers, Stone Spreaders, Unloaders, Drags and other contractors' equipment from the Galion Iron Works & Mfg Co., Galion, Ohio.

59. A new booklet has just been issued by the Universal Road Machinery Company of Kingston, N. Y., describing their full line of portable and stationary crushing, screening and washing units.

Culverts—Large Diameter

60. Ease and speed of installation, economy, a full-width roadway and durable, maintenance-free service, are listed in the new catalog, "Armco Large Diameter Corrugated Pipe," as the advantages following the use of larger diameter culverts in meeting small bridge requirements. Catalog No. 8 will be sent free on request. Address Armco Culvert Mfrs. Association, Middletown, Ohio.

Drag Lines

61. Write for complete catalog on Pioneer Drag Line. Catalog shows cross section of Drum Unit with full description of Frame, Sheaves, Motor and Bucket.—Pioneer Gravel Equipment Mfg. Co., Minneapolis, Minn.

Dump Wagons, Spring Wind-Up

68. Bulletin W-30-J, just issued by Western Wheeled Scraper Company, Aurora, Illinois, illustrates and explains the new Western Automatic Spring Wind-up with which all Western Crawler dump wagons, either new or in service, can be equipped without requiring any attachment on the tractor. This device makes the employment of a wagon man unnecessary.

Dump Wagons, Steel

70. Steel Dump Bodies and hydraulic hoists for Fords and other small trucks are described and fully illustrated in technical literature published by the Wood Hydraulic Hoist and Body Co., 7924-60 Riopelle St., Detroit, Mich.

71. "Steel Dump Bodies." Full data on steel dump bodies for every type of hauling proposition and description of special "Self-Dumper Bodies" for road Builders. Wood Hydraulic Hoist and Body Co., 7924-60 Riopelle St., Detroit, Mich.

Finishing Machine

75. Complete description of Lakewood Finishers, showing use of single and tandem screeds and tamper attachment for high speed production on concrete and bituminous pavements, city streets and highways—32 pages published by The Lakewood Engineering Company, Columbus, Ohio.

Hoists, Truck

85. "Dump Truck Hoist." Double the Truck's value by using power operated Hydraulic Hoists. Catalog of WOOD Hydraulic Hoist and Body Company. Detroit, Michigan, describes Hydraulic Hoists for every make and model of Truck.

Hoppers, Measuring

86. The C. S. Johnson Co., Champaign, Ill., publish a booklet which describes the Johnson Demountable Bins and Measuring Hoppers. Data sent on request.

Hose and Belting

87. Complete information on rubber hose and belting for all types of contracting and road building service available from the Government Sales Department of the Goodyear Tire & Rubber Co., Inc., Akron, Ohio.

Lanterns and Torches

90. Send for interesting catalog in colors of Dietz Lanterns and Road Torches adapted for night traffic warning on any construction work that obstructs the highways. R. E. Dietz Co., 60 Laight St., New York, N. Y.

Loaders and Unloaders

96. Portable car unloaders save money for the contractor on road and other construction projects. Full information on this and on the Reliance Chip and sand spreader on request. Universal Road Machinery Co., Kingston, N. Y.

97. Link-Belt Company, Philadelphia, describes a line of Portable Loaders and Unloaders in Folders: Nos. 1073 and 1074 cover Belt Conveyors with channel iron and truss types of framework; No. 1076, Portable Bucket Elevators for different classes of work; and No. 1149, the "Grizzly" Crawler Loader for heavy work and large capacities.

Motor Trucks

107. "Trucks for Federal, State, County and City Governments," a booklet issued by Dodge Brothers, division of Chrysler Corporation, gives information about

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Name — Street Address — City

4-31

company's trucks in municipal, county, state and government activity.

108. Four-wheel-drive trucks to increase the range of truck operation and for economy of operation for use in road building and maintenance, described in a series of new folders just issued by the Four Wheel Drive Auto Company, Clintonville, Wisconsin.

Paving Materials

111. "Tarvia Double Seal Pavements." Shows, step by step, the construction of a Tarvia pavement. Profusely illustrated with photographs, 24 pages. The Barrett Company, 40 Rector Street, New York.

Plows

112. Plows, Grade Rippers (Scarifiers) and Scrapers are fully illustrated in a new catalogue which will be sent upon request by Wiard Plow Company, Batavia, N. Y. Oldest Plow manufacturers in America.

Power Graders

117. A large wall display piece, No. 3101, printed in three colors and containing a very large illustration of the WARCO Model "E" power grader as well as complete description and working views on center control graders will be sent by the W. A. Riddell Co., of Bucyrus, Ohio, to anyone interested.

Pumps, Contractors'

119. 'Domestic' Contractors' Pumps. Automatic Priming, Ball Bearing Centifugals 2½" to 6" sizes. 'Giant' Road Pumps, 80 and 100 gallons per minute. Dependable Diaphragm and Plunger Trench Pumps and Hoists. Special Bulletins. Domestic Engine & Pump Co., Shippensburg, Pa."

122. Humdinger contractors' pumps. Diaphragm pumps in both the open discharge and the diaphragm force pump types. Self-priming Centrifugal pump, for automatic continuous prime on suction lifts up to 28'. Are described fully and valuable practical information for contractors is given in special Bulletins #107-A and 1034. Ralph B. Carter Co., 53 Park Place, New York, N. Y.

Road Construction

123. "Road Construction and Maintenance" are covered in a new Cletrac Booklet, which takes up such subjects as modern methods of handling large capacity equipment, tandem equipment, etc. Cleveland Tractor Co., 1932 Euclid Ave., Cleveland, Ohio.

Road Rollers, Scrapers, Graders, etc.

125. Plows, Grade Rippers (Scarifiers) and Scrapers are fully illustrated in a new catalogue which will be sent upon request by Wiard Plow Company, Batavia, N. Y. Oldest Plow manufacturers in America.

126. Illustrated catalogs and descriptive material HERCULES All-steel, 6-cylinder road roller. 60 H.P. Gasoline engine. Sizes 5, 7, 8, 10, 12, and 15 tons. Three speeds forward and backward. Cast Steel rollers. The Hercules Company, Marion, Ohio.

127. A 16-page booklet printed in two colors gives full details and specifications of the Erie Roller. Also explains how to use it to save tamping costs. Numerous action pictures. Issued by the Erie Machine Shops, Erie, Pa.

128. A beautiful 32 page book in four colors featuring their entire line of road rollers has been published by the Buffalo-Springfield Roller Co. of Springfield, Ohio. 8¾ x 11, leatherette cover, numerous action pictures.

131. 20-page pocket size booklet showing all types of Buffalo-Springfield motor rollers and scarifiers. The Buffalo-Springfield Roller Company, Springfield, Ohio.

132. "Road Machinery." A sixty-four page data book has been issued by the Austin-Western Road Machinery Company, 400 No. Michigan Ave., Chicago, describing their full line of road building machinery. Included in it are illustrations and descriptions of road graders, 5-foot blade to 12-foot blade; road rollers, steam or gasoline powered, 3 to 15-tons single cylinder to four cylinder. Motor graders, three sizes. Scarifiers. Crushing plant equipment, small road tools. Special bulletins on each separate piece of machinery supplement the general catalog.

133. "Road Rollers." New illustrated booklets covering the entire line of Master 4-Cylinder motor roller, 4-cylinder tandem roller and International motor roller. Galion Iron Works and Manufacturing Co., Galion, O.

134. 36-page, illustrated book describing mechanical features of Huber 4-cylinder Motor Roller and its application to many types of road construction and maintenance. Huber Mfg. Company, Marion, Ohio.

135. Road Machinery Illustrated. New illustrated bulletins on the master Motor Roller, Three-Wheel and Tandem Rollers, Motor Graders powered by Caterpillar, Twin City, Cletrac, McCormick-Deering and Fordson tractors, and Straight and Leaning Wheel Graders. Galion Iron Works & Mfg. Co., Galion, O.

136. Full description of Huber Motor Rollers in sizes from 5 to 15 tons, included in durable 36-page book for use by road contractors and maintenance crews. Huber Mfg. Co., 345 E. Center St., Marion, Ohio.

Sand and Gravel Washing Plants

139. Up to date information on Portable Sand and Gravel Washing Plants with concrete capacities, ranging from 30 to 100 yards per hour.—Pioneer Gravel Equipment Mfg. Co., Minneapolis, Minn.

Screens

140. Full information concerning Shaker and Revolving Screens, Conveyors, Elevators, Bins and Chutes is contained in catalog and special illustrated folders on Pioneer line. Write Pioneer Gravel Equipment Mfg. Co., Minneapolis, Minn.

Shovels, Cranes and Excavators

141. Link-Belt Company, Chicago, in Book 1095, gives valuable information on Heavy Duty Crawler Cranes-Shovels-Draglines, ¾ to 2½-yard capacity, with full line of attachments—grab buckets, trench hoes, dippers, magnets, hook blocks, back-filler boards, grapples, pile drivers, etc.; also complete line of Locomotive Cranes and accessories.

142. The Cranemobile, "successor to Trench Cranes," an adaptation of the crawler mounted Bay City Tractor Shovel is fully described and illustrated in Bulletin C2 just issued by Bay City Shovels, Inc., Bay City, Mich.

145. Catalog K3 just issued, completely describes the light half yard and the full half yard convertible shovel, crane, dragline, trench hoe and skimmer manufactured by Bay City Shovels, Inc., Bay City, Mich. 28 pages, over 50 illustrations, action pictures and charts.

151. The complete line of ½-yd. to 1½-yd. shovels, cranes, draglines, ditchers and skimmers manufactured by the Orton Crane & Shovel Co., 608 S. Dearborn St., Chicago, Ill., is described in Bulletin 60, which also gives lifting capacities and working ranges for the different sizes and types of these crawling tread machines.

Steel Forms

155. A well illustrated catalog of Steel Forms for concrete road, curb and sidewalk construction is available from The Heltzel Steel Form & Iron Company, Warren, O.

Steel Bins

159. Steel bins and measuring hoppers are included in a fully illustrated catalog of Contractors Equipment issued by The Heltzel Steel Form & Iron Company, Warren, Ohio. Write for your copy.

Steel Posts

160. Steel Posts for all purposes. Sweet's Herculean Steel Posts for highway guard rails, fences and other purposes. Catalog and data book. Sweet's Steel Company, Williamsport, Pa.

Tires, Truck and Car

165. Solid, cushion and pneumatic tires and tubes for trucks, cars, tractors, graders and other road machinery. Full information and data available from Government Sales Department of the Goodyear Tire & Rubber Company, Inc., Akron, Ohio.

Tractors, Crawler

169. Cletrac crawler tractors. Cleveland Tractor Co., 19322 Euclid Ave., Cleveland, O. Bulletin 562 describes their use in roadbuilding and maintenance, earth moving, excavating, grading, snow removal, oil field work and lumbering. Made in "20," "30," and "40" and "100" sizes.

170. "Roads," a series of five fully illustrated folders, prepared by the Caterpillar Tractor Co., of San Leandro, Calif., and Peoria, Ill., shows what Russell graders and "Caterpillar" tractors can do and are doing to build better roads quicker and cheaper.

171. The design, construction, details and complete specifications of the new Ten and Fifteen models "Caterpillar" are given in a booklet recently published by the Caterpillar Tractor Co. of San Leandro, Calif., and Peoria, Ill.

173. Cletrac Crawler Tractors are built in a complete line by The Cleveland Tractor Company, 19322 Euclid Ave., Cleveland, Ohio. Cletracs range in size from the 12 h. p. model to the powerful 100 h. p. tractor.

Tractors, Wheel

175. "Huber Tractors" and "The Huber Motor Rollers." Illustrations of machines in operation and testimonials from users. The Huber Mfg. Co., 345 E. Center St., Marion, Ohio.

176. "Kerosene Power, the Low-Price Road Builder," book of data by the International Harvester Co., 606 So. Michigan Ave., Chicago, shows economy of kerosene tractors. Illustrations, specifications and figures on cost of operation.

Truck Cranes

182. Full-revolving, gasoline-operated Truck Cranes with a capacity of 7½ tons at a 10 ft. radius, for mounting on a 5-ton or 7½ ton auto-truck, are described in Bulletin 62, issued by the Orton Crane & Shovel Co., 608 S. Dearborn St., Chicago, Ill.

Truck Hoists

183. "Dump Truck Hoists." Double the Truck's Value by using power operated Hydraulic Hoists. Booklet published by WOOD Hydraulic Hoist and Body Company, 7924 Riopelle St., Detroit, Michigan, describes Hydraulic Hoists for every make and model of Truck.

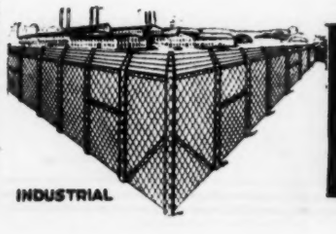
Wheeled Scoops

190. The WARCO wheeled scoops, claimed to offer the most economical handling of earth on short hauls, is fully described and illustrated in Bulletin No. 3102 issued by the W. A. Riddell Co., of Bucyrus, Ohio. Printed in three colors and fully illustrated—will be sent to anyone interested.

Road and Street Maintenance

Asphalt Heaters

201. Tar and Asphalt Kettles, Oil Burning Kettles, Pouring Pots, Torches and Hand Spraying Attachments. Full data. Connery & Company, Inc., of Philadelphia.



SWEET'S STEEL POSTS

Rolled from the highest grade Carbon steel --- easy to drive --- self contained --- with pleasing appearance and high safety factor.

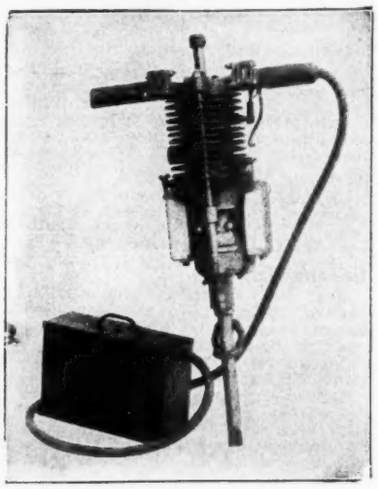
Write for Descriptive Catalog

SWEETS STEEL COMPANY
WILLIAMSPORT, PA.

Equipment for Construction Economy

Rodax—An Easily Portable Gasoline Hammer

The Rodax Corporation, Chicago, Ill., have brought out a new type of tool. Rodax is a one-cylinder gasoline driven hammer for breaking concrete, driving sheeting, digging frozen ground, mechanical tamping, shallow drilling and other similar purposes. It is complete in a single compact unit. A hard-hitting, powerful tool, ruggedly built, striking approximately 1,000 blows a minute and operating with a high degree of efficiency. It takes any standard 1⅛ inch shank. Tools for all



The Rodax is a gasoline driven, portable, power hammer with a wide variety of uses

purposes, especially designed for this machine can be purchased.

Advantages of this tool include the fact that it is easily portable, is very low in first cost and is very economical in operation.

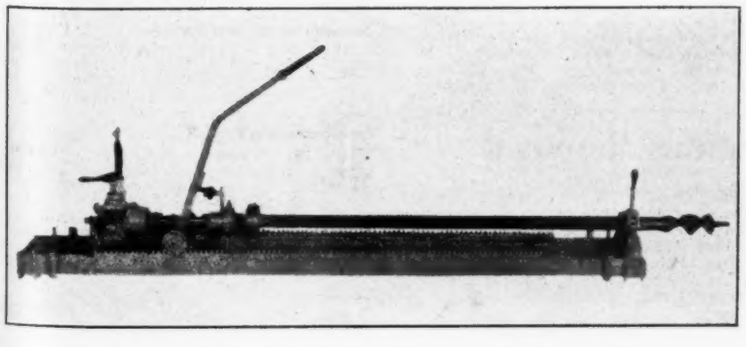
Rodax is manufactured by the LeRoi Co., Milwaukee, Wis.

Reducing Tunneling and Pipe Laying Costs

The Hydrauger Corp., Ltd., 1298 Bryant St., San Francisco, Calif., manufacture the Hydrauger, which is designed to drill horizontally and accurately under a street or highway. It is claimed that in 90% of the cases accuracy within two or three inches is attained at 40 feet. Only two small pits need be dug. Operation is by compressed air and running water.

Through normal soils it is said that speeds ranging from 1 ft. per minute for a 2½-inch bore to 0.5 ft. per minute for a 10½-inch bore can be averaged. With a 110-ft. compressor and wages at 75 cents an hour the costs are set at $0.067 per foot for 2½-inch; from $0.084 to $0.112 per foot for 5-inch and $0.15 per foot for 10½-inch bore, which are estimated to be one-tenth or less of the cost of cutting through the pavement.

Hydrauger boring horizontally under three railroad tracks—120 feet. End of bore shown by workman in upper right corner. Bore 8½ inch. Actual time, 2½ hours, including digging pits at each end. Roadbed not disturbed. Hydrauger is shown at left below.

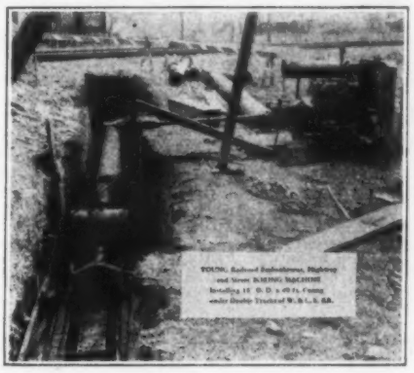


Horizontal Underground Boring Machine

The Young Engine Corporation, Canton, Ohio, has designed a boring machine to meet the demand for a machine to install casings, pipe lines, water lines, conduits, sewers, etc., through embankments, under paved highways, streets, and railroads by boring, using the pipe to be installed and which remains in the ground as the medium for carrying the cutter head. As the roadbed or embankment is not disturbed there is no backfilling to be done nor is there any hold up of traffic on the highways or slow orders on a railroad job.

The boring machine is constructed strong enough to handle casing up to 30″ O.D. or even larger. It is 2½ ft. wide x 9 ft. long, weighing approximately 3200 lbs.

By means of a three-legged pipe tripod and chain hoist it can be easily



The Young underground boring machine will handle casings up to 30-inch size or even larger

and quickly unloaded from truck, lowered into ditch and likewise removed. The machine requires widening of the ditch to 3 ft. for a length of 10 ft. It is braced to prevent sliding backwards.

The casing is attached to the 8″ hollow rotating driving sleeve on the forward end of which is an 8 x 12½″ forged steel flange. If the casing is larger or smaller than 8″ then a swedge nipple is required between casing and driving flange. A suitable hard faced forged steel cutting head is welded on forward end of casing. The combined rotating and forward motion produced by the boring machine forces the cutter into the soil. The dirt is removed through the hollow sleeve by means of a spoon or scoop operated on sufficient length of 1¼″ pipe or in favorable location the cuttings can be washed out by water.

For bulletin 15W and other data write Young Engine Corporation, Canton, Ohio.

202. Connery & Company, Inc., 3900 N. Second St., Philadelphia, Pa., has issued a new Bulletin "J" describing the latest and improved style "J" Oil Burning Kettle for Paving Contractors, Street and Highway Departments.

203. A 54-page booklet issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates oil, wood and coal burning asphalt and tar kettles, tool heaters, sand dryers, tool boxes, traffic line markers, grout mixers, asphalt tools, etc.

Dust Control

210. "How to Maintain Roads," by the Dow Chemical Company, Midland, Michigan, is a manual dealing thoroughly with dust control, road building and maintenance. It contains tables and composition, grading, etc.

211. "Dust Control," a concise, handy pocket reference on control of dust by use of 3C Calcium Chloride. Illustrated. Issued by the Columbia Products Company, Barberton, Ohio.

Dust Laying

213. Solvay Sales Corporation, New York, supplies full information regarding the use of Solvay Calcium Chloride for effectively laying dust. The booklet, "Solvay Calcium Chloride, a Natural Dust Layer," 24 pages, 5½x8, covers application, economies, etc. Sent without cost.

Equipment

215. "Road and Street Maintenance Equipment," a compact vest pocket manual containing illustrations and brief descriptions of their extensive line, has just been issued by Littleford Bros., 452 East Pearl St., Cincinnati, Ohio.

216. "Light and Heavy Road Maintenance" is the title of a recent folder showing the tremendous power developed by the FWD truck and its economy for use in pulling road graders and maintainers—issued by the Four Wheel Drive Auto Company, Clintonville, Wisconsin.

Road and Paving Materials

Asphalt Plank

220. The Philip Carey Company, Cincinnati, Ohio, has available a handsome booklet describing Elastite Asphalt Plank for Bridge Flooring—with specifications for use—liberally illustrated with photographs.

Concrete Curing

235. "How to Cure Concrete," is a manual of instruction on the curing of concrete pavements. A handy, useful volume, well illustrated. 47 pages, 5½x7½. The Dow Chemical Company, Midland, Mich.

Culverts, Corrugated

236. The added advantage in using Toncan Iron Culverts under highways for airport drainage, storm sewers, suburban allotments, etc., because of Toncan's alloy composition, is described in bulletin—"We are living in the Alloy age"—Toncan Culvert Mfrs. Association, Massillon, Ohio.

Culverts—Corrugated Metal

238. A new 24-page, well-illustrated catalog, listing the advantages that follow the use of Armco corrugated iron culverts and containing complete instructions for ordering and installation has been published by Armco Culvert Mfrs. Association, Middletown, Ohio. Write for Culvert Catalog No. 6.

Expansion Joint for Pavements

250. Premoulded Expansion Joints in several different types, including a new asphalt rubber joint, in order to meet various construction conditions are covered in literature issued by the Servicised Premoulded Products, Inc., 53 W. Jackson Blvd., Chicago, Ill.

251. Full information on the use of Expansion Joints in pavements, bridges, pools, walls and other concrete work, including best installation methods, may be obtained from The Philip Carey Company, Cincinnati, Ohio.

Jacking Method

260. No interruption to traffic, and substantial savings in construction costs are the main advantages secured by using the Armco jacking method to install conduits, drainage openings, and passageways under streets, highways and railroads. A new catalog, "The Armco Jacking Method," describing this modern means of construction and its many applications, will be sent upon request, by Armco Culvert Mfrs. Association, Middletown, Ohio. Ask for Catalog No. 7.

Maintenance Materials

267. "Mixed-in-Place Construction with Tarmac." Step-by-step pictures and specifications for constructing road surfaces by Retread or Turnover methods American Tar Products Co., Koppers Bldg., Pittsburgh, Pa.

268. Road and street maintenance and reconstruction with BITUMULS Cold Asphaltic Binder described in an illustrated paper by C. H. Thomas, Maintenance Engineer. Reprints furnished by American Bitumuls Company, San Francisco or Baltimore.

270. "How to Maintain Roads," by the Dow Chemical Company, Midland, Michigan, is a manual dealing thoroughly with road building, maintenance and dust control. It contains tables of composition, grading, etc.

272. "Asphalt for Every Purpose," a 44-page illustrated booklet describing Stanolind Asphalt products is now ready for distribution. Recently published by the Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

273. Complete directions for surface treatment and bituminous surfacing with Cut Back Asphalt are contained in a 36 page data book just issued by the Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

275. "Tarvia-K. P. for Cold Patching." An instructive booklet illustrating and describing each step in patching a road with "Tarvia-K. P." 16 pages, illustrated, 3½x9. The Barrett Company, New York.

276. "Road Maintenance with Tarvia." A 56-page illustrated booklet of value to every road man. Shows how almost every type of road and pavement can be repaired and maintained with Tarvia. The Barrett Company, New York.

277. "Tarvia." An attractively illustrated 32-page booklet describing grades of Tarvia and showing photographs of actual application. The Barrett Company, 40 Rector St., New York City.

278. Information regarding crack and joint fillers furnished in gray, black, or other colors, for poured joints, also maintenance and repair work may be obtained by application to the Servicised Premoulded Products, Inc., 53 W. Jackson Blvd., Chicago, Ill.

Rail Filler

281. Bituminous Rail Filler used for sound deadening, rail insulation and pavement protection is described in pamphlet issued by Servicised Premoulded Products, Inc., 53 W. Jackson Blvd., Chicago, Ill.

282. Write to The Philip Carey Company, Cincinnati, Ohio, for complete and interesting data on the application of Elastite Rail Filler in Street Railway Tracks.

Garbage and Refuse Disposal

305. "Pittsburgh-Des Moines Incinerator," built and guaranteed by the Pittsburgh-Des Moines Steel Company, 79 Neville Island, Pittsburgh, Pa., is described fully in a booklet sent on request.

Snow Removal

Snow Removal

348. "Winter Maintenance" is the title of a recent booklet issued by the Four Wheel Drive Auto Company, Clintonville, Wisconsin. Illustrates many types of snow plows and methods of handling snow removal problems.

349. "The Answer to the Snow Removal Problem" is the title of a new booklet just published by Carl Frink, Mfr., of Clayton, N. Y. It gives full details of the new Frink type S snow plow for trucks.

353. Efficient methods of combating quickly the snow menace on highways and city thoroughfares. Illustrates joint use of crawler tractors and standard and special snow plows. The Cleveland Tractor Co., 19322 Euclid Ave., Cleveland, Ohio.

354. "Snow Removal Equipment," a colorful booklet just off the press of the Caterpillar Tractor Co., of San Leandro, Calif., and Peoria, Ill. Various types of snow-fighting equipment built for "Caterpillar" Tractors are pictured in relief and in action.

358. The new Type "S" Frink Sno-Plows and Frink Leveling Wings, together with complete data for selecting the proper size snow plow for your particular make and model of truck. Published by Carl H. Frink, Clayton, N. Y.

359. Calion Iron Works and Mfg. Co., Calion, Ohio, will gladly furnish details, prices and catalogs of their snow plows adaptable to any make of truck.

Sewerage and Sewage Disposal

Activation and Aeration

390. A new booklet describing Norton Porous Mediums of bonded fused alumina (strong, chemically stable, uniformly permeable), the booklet will be of interest to all chemical and sanitary engineers. Issued by Norton Co., Worcester, Mass.

Inlets and Manhole Covers

400. Cast iron sewer blocks, ventilators, manhole covers and inlets, valves, etc., described in pamphlet by the South Bend Foundry Co., South Bend, Ind.

Jointing Materials

401. G-K Compound for vitrified clay sewers, MINERALEAD for bell and spigot water mains, also M-D Cut-Ins for making house connections, described in catalogue of Atlas Mineral Products Company, Mertztown, Pennsylvania.

402. An illustrated folder has just been issued by the Cochrane Chemical Co., 432 Danforth St., Jersey City, N. J., detailing the advantages and the savings in the use of Ex-XL-cell Sewer Pipe Joint Compound.

403. A recent publication of the Servicised Sales Company, Monadnock Block, Chicago, Illinois, tells of the superior tightness, flexibility and durability of fibrated asphalt Sewer Pipe Belts and Joint Compounds. Complete instructions and considerable data are included in the pamphlet, now available.

Pipe, Vitrified

405. Full information regarding Vitrified Pipe and other heavy clay products. Illustrated price list on application. Factories in Pennsylvania and Ohio. The Progressive Clay Co., offices in New York City, Philadelphia, Pa., and Syracuse, N. Y.

Sewage Screens

414. The Dorr Co., 247 Park Ave., N. Y., publishes Bulletin No. 6391, which describes the construction and operation of the Dorrco Mechanically-Cleaned Bar Screen.

415. Link-Belt Company, Philadelphia, shows in Book 642 its line of sewage screens (Tark, Brunotte, and Straightline) for fine and coarse sewage; Straightline Collectors for Settling Tanks (Sludge, Scum and Grit; and Mechanical Aerators for activated sludge plants.

Sludge Bed Glass Covers

418. Sludge Bed Glass Covers—"Super-Frame" Hitchings & Co., Main Office, Elizabeth, New Jersey. Offer A. I. A. File 101SB, Describing glass covers for sludge and sprinkler beds.

Storm Sewers

424. A 24-page catalog, profusely illustrated with actual installations under widely varying conditions, which lists the features that give superiority to flexible corrugated metal construction for storm sewer installations, can be obtained from Armco Culvert Mfrs. Association, Middletown, Ohio. As for the catalog No. 5.

Treatment

425. Dorr Company, 247 Park Ave.,

Engineering and Construction Equipment

Eliminates Inking of Drawings

The "No-Ink" drawing board top manufactured by W. H. Long Co., 420 N. Clark St., Chicago, Ill., is an especially fine, white composition which gives a permanent white, smooth, perfect drawing surface, tough, resilient, stain-proof, scratch-proof, mar-proof and washable with soap and water.

Its use is simple. No Manila paper is used. The regular drawing paper is attached directly to this surface, and a 3-H or harder pencil is used. All lines are drawn with a double stroke and with a slight pressure on the pencil. The pressure of the first stroke ridges the paper, and the back stroke fills that valley evenly with lead. The result is a solid, opaque, even edged line, reproductions of which (blue-prints, van dykes, etc.) are as clear cut and readable as an inked line. Changes can be made in any line by the usual rubbing out process, and the ridges or valleys will not show on reproductions. Because of the resiliency of the board the indentations in the surface made by the pressure of drawing tools disappear immediately. Due to the use of hard lead which lies in a valley, the lines do not smudge when worked over for any length of time, and hence these drawings, even when filed away, can be taken out at any time and readable prints made of them.

The Euclid "Track Wheel" Hydraulic Dump Wagon

In the Euclid "Track Wheel" Hydraulic bottom dump wagon, the Road Machinery Division of the Euclid Crane and Hoist Company presents one of the most modern and economical pieces of equipment for earth haulage. The tractor driver has complete control of dumping and door closing operations from his driving position. No manual effort is required at the dump as all door motions are operated hydraulically by means of a lever conveniently located at the driver's seat.

Sullivan Concrete Breaker

These wagons are built in 5½, 6, 7, and 8-yard capacities. The 5½ and 7-yard wagons are built with a low side for elevating grader use but can be converted into 6 and 8-yard capacities by adding top extensions to the low side and ends. The Hydraulic "Track Wheel" Wagons are identical in design and construction with the hand wind with the exception of the hydraulic pump and lifting jack.

The drawbar lifting jack is an additional feature of Euclid "Track Wheel" Wagons and makes the operation of attaching or detaching from the tractor a one man job instead of a laborious task for several men.

New Sullivan Concrete Breakers

Sullivan Machinery Company (400 N. Michigan Avenue, Chicago) has brought out two new improved Concrete Breakers described as follows: "K-5" 72-lb. 25¼ inches long, overall, and the "L-6" 80-lb. 28½ inches long overall. The "K-5" Buster is intended for all ordinary work, while for unusually heavy conditions such as smashing the hardest steel reinforced concrete, the "K-6" with striking block or anvil construction is available.

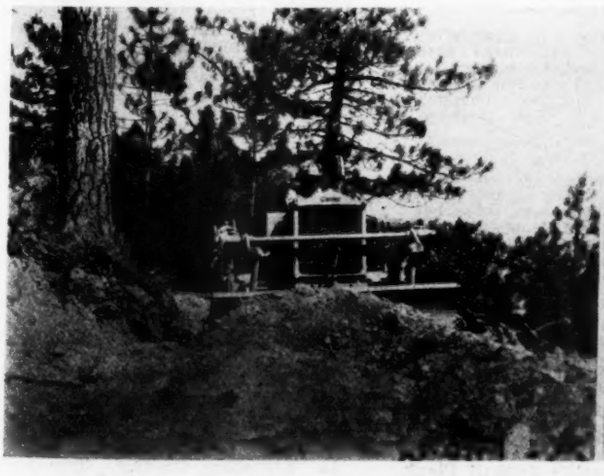
Armco Paved Invert Pipe

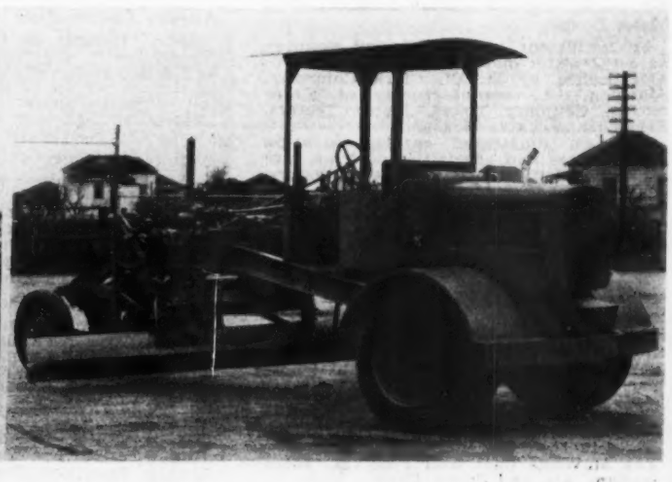
Longer life for culverts and drains, less frequent replacements, less traffic interruption, increased adaptability to re-use and more improvement per dollar spent, are the main advantages given as following the use of Armco Paved Invert Pipe in a new, twenty-four page, well-illustrated catalog, "Armco Paved Invert Pipe," now ready for distribution by Armco Culvert Mfrs. Association, Middletown, Ohio.

The "Caterpillar" Auto Patrol

The "Caterpillar" Auto Patrol is designed and engineered throughout as a heavy duty maintenance machine capable of doing all kinds of maintenance work. On first speed this machine will do an excellent job of scarifying for it has the proper weight, power and traction. The scarifier has a double row of teeth which gives more clearance between the teeth for larger particles. First speed is also adapted to oil-mix work as well as extremely heavy blading work. Second speed is an ideal rate for normal surface maintenance work. Third speed is for lighter surface maintenance work and means many more miles of road work per day. Fourth speed is a special high speed to get from one job to another in a hurry and six pneumatic tires makes this possible without the usual vibration found in most big maintenance machines.

Below, left: A Cletrac in use by the U. S. Forest Service. Many of these machines are in use building trails through forest preserves. Right: The Caterpillar Auto Patrol is designed for heavy maintenance work of all kinds





New York, in its Sanitary Engineering bulletin describes the use of its equipment for treating municipal sewage, industrial wastes and water. Photos of numerous operating plants are shown as well as representative flow sheets illustrating the various methods of sewage treatment.

427. The Pacific Flush Tank Company, of Chicago and New York, publish eight separate catalogs on Sewer and Sewage Disposal Automatic Equipment, including pumps, Imhoff Tanks and Sewer Joint Compounds. These are of real value to the designer or operator of a treatment plant.

428. Advantages of Liquid Chlorine for disinfection given in booklet issued by the Electro Bleaching Gas Co., 9 East 41st St., New York.

429. Chlorine is being extensively used in the disinfection of sewage not only as a disfectant but as an aid to other purification processes. Wallace & Tiernan Co., Inc., Newark, N. J., have a publication, No. 42, on the chlorination of sewage, which will be sent to any address on request.

430. The Dorr Co., 247 Park Ave., N. Y., publishes Bulletin No. 6171, which describes the treatment of sewage with Dorr Traction Clarifier, an improved type of continuous sedimentation for use in water and sewage treatment plants.

432. The Dorr Company, 247 Park Ave., N. Y. C., publishes Bulletin No. 6481, which describes the construction and operation of the Dorr Detritor for continuously removing and washing the grit from sewage flows.

434. Automatic, continuous vacuum filters, producing a relatively dry cake of sludge in demand for fertilizer, are used by: Milwaukee, Houston, Chicago, Gastonia, N. C., Charlotte, N. C., write for literature. Oliver United Filters, Inc., Federal Reserve Bank Bldg., San Francisco, Calif.

Water Works Equipment

Activation and Aeration

465. A new booklet describing Norton Porous Mediums of bonded fused alumina (strong, chemically stable, uniformly permeable), the booklet will be of interest to all chemical and sanitary engineers. Issued by Norton Co., Worcester, Mass.

Couplings and Tees

485. Copper pipe for water works services and patented connections for jointing to corporation stops, iron pipe, etc. Full data 22 pages 8½ x 11. The Mueller Co., Decatur, Ill.

505. "Mathews" Fire Hydrants. Gate Valves and other water works appurtenances. 16 pages, 7¾x10¾. R. D. Wood & Co., Philadelphia.

506. Hydrants, tapping apparatus, gate locks, valves and curb cocks described in a series of bulletins issued by A. P. Smith Mfg. Co., East Orange, N. J.

Jointing Materials

515. MINERALEAD for bell and spigot water mains, G-K Compound for vitrified clay sewers, also M-D Cut-Ins for making house connections, described in catalogue of Atlas Mineral Products Co., Mertztown, Pa.

Meter Boxes

525. Efficient installation and maintenance of water meters is described in catalog issued by H. W. Clark Company, Mattoon, Ill., manufacturers of Meter Boxes, Coupling Yokes, Meter Testers, Service and Valve Boxes.

526. An illustrated catalog covering meter boxes and specialties such as gate valve housing, curb boxes, meter testers, melting furnaces, jointing materials, four-in-one pumps, has recently been published by the Hydraulic Equipment Co., Reading, Pa.

Pipe, Cast Iron

534. "Sand-Spun," Centrifugal cast iron pipe manufactured by R. D. Wood & Co., Philadelphia, is fully described in a valuable 16-page 6x9 booklet, containing also complete specifications of this pipe. No engineer or water works official should be without this booklet.

535. Cast Iron Pipe and Fittings, sizes 1¼ through 12 inches, either with or without Precaulked lead joints factory-made in the bells. Data book sent free. The McWane Cast Iron Pipe Co., Birmingham, Ala, and Provo, Utah.

536. "Weights and dimensions of Cast Iron Pipe and Fittings." A handy reference book for Municipalities and Contractors. 48 pages, 7¾x10¾. R. D. Wood & Co., Philadelphia.

537. "Uinversal Cast Iron Pipe," for water supply, fire protection and sewage disposal. All jointing materials eliminated. Machined iron-to-iron joints made with wrenches only. (Booklet). The Central Foundry Company, 420 Lexington Ave., New York, N. Y.

538. "High Pressure Fire Protection Lines." Booklet containing excerpts from Underwriters report on Universal Cast Iron Pipe. The Central Foundry Company, 420 Lexington Ave., New York, N. Y.

539. U. S. Cast Iron Pipe Handbook contains useful tables and data for the Water Works man on pipe line construction. Issued by U. S. Cast Iron Pipe and Foundry Company, Burlington, N. J.

Pipe, Cement Lined

540. Steel or Wrought Iron Pipe lined with cement and special lead-lined joints, manufactured by the Cement Lined Pipe Co., of Lynn, Mass.

Pipe for Subdrainage

549. The benefits following the use of Armco perforated iron pipe for various municipal uses such as golf course, athletic field, and airport drainage; and its various applications in the construction and maintenance of highways and railroads are outlined in the 24-page illustrated catalog entitled, "Armco Perforated Iron Pipe." Catalog No. 4 is obtainable upon request from Armco Culvert Mfrs. Association, Middletown, Ohio.

Pump Packing

575. "When Power Is Down," by the Sterling Engine Company, Buffalo, N. Y., gives recommendations of models for standby services for all power requirements.

Service Boxes

578. "Service Boxes with Stay-on Covers. No more broken covers. No more lost covers." (Booklet). The Central Foundry Company, 120 Lexington Avenue, New York, N. Y.

Swimming Pools

580. Wallace & Tiernan Co., Inc., Newark, N. J., have just published a new edition of technical publication, No. 41, dealing with the sterilization of swimming pools by liquid chlorine. Copy sent on request.

Tanks and Stand Pipes

582. A 50-page booklet issued by Pittsburgh Des Moines Steel Co., 79 Neville Island, Pittsburgh, Pa., on complete water works plants, elevated tanks, stand pipes and filtration plants built by them.

Tapping and Valve Machines

583. The A. P. Smith Company, of East Orange, N. J., furnish descriptive matter dealing with their many labor saving devices as the Smith tapping machine, valve inserting machine and pipe cutting machines.

Miscellaneous

Airport Construction

597. "Getting on the Air Map With 'Caterpillar'," profusely illustrated with action pictures, describes the many uses of the tractor in building and maintaining airports better, quicker, cheaper. Caterpillar Traction Co., San Leandro, Calif., and Peoria, Ill.

Airport Drainage

599. The added advantage in using Toncan Iron Culverts under highways for airport drainage, storm sewers, suburban allotments, etc., because of Toncan's alloy composition, is described in bulletin—"We are living in the Alloy age"—Toncan Culvert Mfrs. Association, Massillon, Ohio.

Asphalt Bridge Planking

600. A new and improved asphalt composition has been developed as a long wearing and resilient paving material for bridges, viaducts, railroad platforms, etc., covered by Catalog No. 12, now available from Servicised Premoulded Products, Inc., 53 W. Jackson Blvd., Chicago, Ill.

601. The Philip Carey Company, Cincinnati, Ohio, has available a handsome booklet describing Elastite Asphalt Plank for Bridge Flooring—with specifications for use—liberally illustrated with photographs.

Asphalt Construction

605. Methods of mixing BITUMULS Cold Asphaltic Cement with natural soil or gravel for inexpensive landing areas and of constructing BITUMULS (cold) penetrated runways described in construction reports furnished by the American Bitumuls Company, 503 Market Street, San Francisco.

Community Advertising

610. Booklet showing various forms of publicity matter useful in arousing interest in the construction of small town water supplies. This matter is furnished free to Consulting Engineers and towns interested in waterworks construction by The Cast Iron Pipe Research Association, 566 Peoples Gas Bldg., Chicago, Ill.

Highway Crossings

612. A most serviceable and durable railroad crossing for city streets and main highways, is composed of fibrated asphalt planking and rail filler sections. Complete description and data will be furnished by Servicised Premoulded Products, Inc., 53 W. Jackson Blvd., Chicago, Ill.

Industrial Flooring

615. An extremely serviceable Fibrated recent contributions to industrial efficiency. *Duo-Type Flooring*—interlocking Asphalt Industrial Flooring is one of the sections with asphalt plank base and rubber block wearing surface offers a splendid combination of these products. Ask for pamphlets from Servicised Premoulded Products, Inc., 53 W. Jackson Blvd., Chicago, Ill.

Municipal Drainage Products

620. A complete line of drainage products which meets the modern municipal need for drainage materials that are quickly installed, safe, and dependable and economical in service is described in the new 24-page, illustrated catalog, "Armco Municipal Drainage Products." A request to Armco Culvert Mfrs. Association, Middletown, Ohio, for Catalog No. 9 will bring you this book free of obligation.

Rules

625. The Lufkin Rule Company, Saginaw, Mich.; New York; Windsor, Canada. Manufacturers of Measuring Tapes, Boxwood Rules, Spring Joint Rules, Straight and Folding Steel Rules, Fine Mechanics Tools and Aluminum Folding Rules. General Catalog No. 11.

Tree Moving

632. "Tree Moving," folder from the Caterpillar Tractor Co., of San Leandro, Calif., and Peoria, Ill., shows and tells with action pictures and the letters of landscaping experts how to successfully move large trees.

Waterproofing and Dampproofing

635. Headley Emulsified Products Co., Philadelphia, has issued Bulletin 330, which gives some very valuable information regarding dampproofing, insulating, and waterproofing methods and materials for floors, walls, roofs, tanks, swimming pools, etc.

Waterproofing Protection Course

640. Fibrated Asphalt Waterproofing Protection Course planks as now used for protection course to membrane waterproofing on railroad structures, viaducts, large roofs, etc., is described in Catalog No. 12, issued by Servicised Premoulded Products, Inc., 53 W. Jackson Blvd., Chicago, Ill.

New Catalogs

Not described before in this Industrial Literature Section

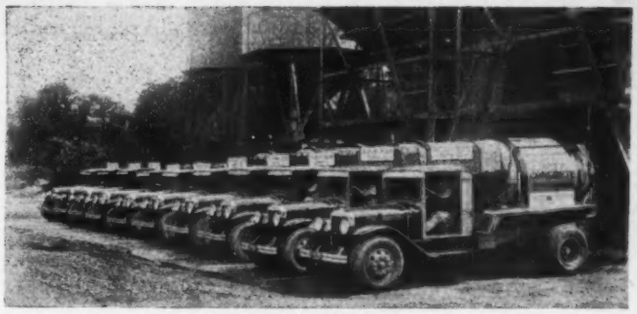
Clamshell Buckets

27. The Owen Bucket Company, Cleveland, Ohio, have available illustrated folders on Clamshell Buckets showing the various types, sizes and uses for which they are intended and construction features and other valuable bucket information. A complete catalog on all types of Clamshell Buckets will also be furnished on request.

Graders

75. Elevating Graders. Two publica-

New Developments in the Public Works Field



A fleet of Jaeger truck mixers

Jaeger Dual-Mix Truck Mixers

Increasing use of commercial concrete for building and road construction is evidenced by the growth of the truck mixer fleets manufactured by The Jaeger Machine Company, Columbus, Ohio. A pioneer in the truck mixing field, this company has equipped well over 100 commercial plants. Jaeger machines employed as truck mixers, are equipped with accurate water measuring tanks for supplying pre-determined amounts of water to the batch carried in the mixer drum. When intended for use as agitators, this tank and water distributing system are not supplied.

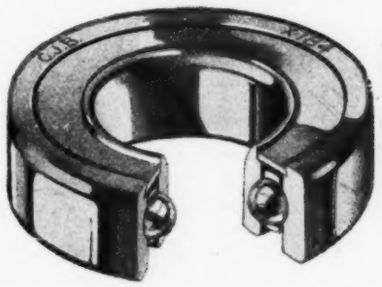
Power is derived either direct from the truck engine or from a separate engine mounted as part of the mixer body assembly. Controlled discharge of any slump concrete at any speed is assured by the spiral mixing blades of the Jaeger drum which create a positive discharge action when the direction of drum rotation is reversed. No hoist is needed, even for discharging up steep gardes, as is sometimes necessary on the job.

Straightline Sewage Screen

The Link-Belt Straightline Screen consists of a rack made up of steel bars, usually set vertical or at an angle of about 60° with the horizontal. The clear openings between bars may be from ⅝" up, depending on requirements, and the screens are made of any width from 3 ft. up to 15 ft. or more if desired.

The rack is cleaned by a rake, secured to a carriage, which travels back and forth over the screen bars. On the upward travel the rake engages with the rack and carries the accumulated solids up to the top of the screen. As the rake passes the top of the screen a scraper cleans off the adhering solids into a trough or conveyor. It is then carried back, clear of the rack, to the bottom of the screen, where it is again lowered into engagement with the bars for a repetition of the operation.

The speed of the rake is approximately 7 ft. per minute. By means of a time relay the rake is stopped at the highest and lowest position for half a minute. This time may be varied up to 30 minutes to suit local conditions.



Ball Bearings improve even sewer cleaning machines

Very heavy solids may be handled by it without any damage to the machine. Ample safety devices are provided to stop the machine if boards or any other heavy material should become jammed between the racks. Means are provided for adjusting the rakes in relation to the screen so that rakes do not ride on the screen.

One set of machinery can drive several units. If two units are used, the carriages are counterbalanced, one going up, while the other one comes down.

Link-Belt Sewage Treatment Plant Book No. 642 describes the unit. This book will be sent upon request to 2045 W. Hunting Park Ave., Philadelphia, Pa.

Ball Bearings Improve Sewer-Cleaning Machines

Greater efficiency and durability have been secured in Turbine sewer machines through the use of special improved type ball bearings, according to an announcement of the Turbine Sewer Machine Co., 5210 State Street, Milwaukee, Wis. This company uses a special bearing constructed of the finest tool steel and machined to the closest limits, with spherical ball bearings, so constructed that they can be greased at the plant when installed.

This type of bearing runs more easily, has longer wearing qualities and will remain lubricated for the life of the equipment. Although this bearing costs five times as much as the type previously used, it is believed that the customer will reap the benefit in trouble-free service, as the bearing should never have to be replaced.

Armco Spiral Welded Pipe

Spiral welded pipe is the latest development in the field of pipe manufacturing. It is manufactured by The American Rolling Mill Company, of Middletown, Ohio.

Among the favorable features to be found in this new Armco spiral welded pipe is lighter weight, easier handling, long sections which reduce the number of field joints, smooth inside wall which reduces friction and pumping costs, and, of course, a saving in shipping and handling costs.

Armco spiral welded pipe is manufactured in jointless lengths up to 40 feet. It is round, straight, smooth inside and light in weight. There are no interior grooves nor ridges to catch sediment or debris, or increase friction. Every ounce of metal is used to form the side walls; there are no projecting bands nor seams to add non-utilized weight. It is especially easy to weld, and can be used with any of the standard couplings.

Armco is now supplying this pipe in sizes ranging from 6" to 24" in diameter, in any wall thickness from 12 gage to ¼ or ⅜ inch.

The T. H. Morgan Paving Co., Sacramento, used this fleet of International Harvester Trucks, Heil equipped, to keep things moving on a $250,000 highway building project in San Joaquin County, California

tions by the Caterpillar Tractor Co., Peoria, Ill., illustrate the Caterpillar Sixty Grader with and without engine.

Excavating Buckets

80. The Owen Bucket Company, Cleveland, Ohio, have available illustrated folders on Excavating Buckets showing the various types, sizes and uses for which they are intended and construction features and other valuable bucket information. A complete catalog on all types of Excavating Buckets will also be furnished on request.

Paving Materials

109. A 36 page booklet with 66 illustrations has just been issued by the Barrett Co. giving full information regarding the making, laying and maintaining of "Tarvia-lithic," the ready-to-lay pavement.

Road Construction

124. Building Roads Better, Cheaper and Quicker. A book by the Caterpillar Tractor Co., Peoria, Ill., telling how smooth, well-built roads can be built better, cheaper and quicker. It pictures the machines which do this work, and tells how the machine's economy, dependability and stamina are important.

129. Caterpillar publications as follows: Sixty Leaning Wheel Grader, the Super-Special Grader, the Motor Patrols, the Twenty Planer, the Hi-Way Patrol Grader No. 3, the Ten Motor Patrol, and the Auto Patrol. These cover a wide range of valuable and useful information on road-building machinery. Caterpillar Tractor Co., Peoria, Ill.

Surface Heaters

220. The new "Hotstuff" three in one, combination Tool, Asphalt and Surface heater is fully described and illustrated in Bulletin 16 just issued by the Mohawk Asphalt Heater Co., 56 Weaver St., Schenectady, N. Y.

Material Handling Buckets

280. The Owen Bucket Company, Cleveland, Ohio, have available illustrated folders on Material Handling Buckets, showing the various types, sizes and uses for which they are intended and construction features and other valuable bucket information. A complete catalog on all types of Material Handling Buckets will also be furnished on request.

Sand and Gravel Buckets

290. The Owen Bucket Company, Cleveland, Ohio, have available illustrated folders on Sand and Gravel Buckets showing the various types, sizes and uses for which they are intended and construction features and other valuable bucket information. A complete catalog on all types of Sand and Gravel Buckets will also be furnished on request.

Sewer Joint Compound

404. Full details concerning No. 1 Korite for sealing sewer pipe joints so that they will be permanently tight are contained in an illustrated folder just issued by the Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

Sewer Cleaning Machines

416. Illustrated booklet describing Adjustable Turbine Sewer Cleaners, Self-Propelling Ferret Turbines, Drag Type Sewer Cleaners, Five Types of Sewer Rods, Conduit Rods, Windlasses, Sewer Braces, Sewer Cables. Turbine Sewer Machine Co., 5210 W. State St., Milwaukee, Wisc.

Valves

585. Catalog covering our line of Bronze and Iron Valves for service on Steam, Water, Gas, Gasoline, Air and Oil lines furnished upon request. Also data on "Dart" Unions and Fittings. The Fairbanks Company, 393 Lafayette Street, New York, N. Y.

Chains and Speed Reducers

607. Link-Belt Co., Indianapolis, Ind., gives full description of its positive drives in books. No. 125 Silent Chain; No. 1257, Roller Chain; No. 815, Herringbone Speed Reducers; No. 1050, Promal Chains. Send for these positive power transmission books.

Miscellaneous

620. Pipe Lines and the Caterpillar. In this 32-page booklet are pictured many uses of the Caterpillar Tractor, and ways in which they can be applied to the saving of men, money and minutes. The Caterpillar Tractor Co., Peoria, Ill.

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